# YACHTS AND YACHTING

BY VANDERDECKEN,

BEING A

TREATISE ON BUILDING, SPARRING, CANVASSING, SAILING AND THE GENERAL MANAGEMENT OF YACHTS,

WITH

REMARKS ON STORMS, TIDES,

&c., &c.

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# PREFACE.

The sporting papers lately recorded the death, in the prime of life, of William Cooper, Esq., who, under the *soubriquet* of "Vanderdecken," for many seasons wrote those spirited accounts of regattas which used formerly to appear in a weekly contemporary; and we fear that, however well the yachts of the present day may deserve to have their doings recorded, their performances will never shine with such lustre as did those of the Cygnet, Heroine, Mosquito, and Cynthia, in the larger class, or of the Whisper, Secret, Phantom, and Thought, in the smaller class, in days gone by, for want of such an historian as "Vanderdecken;" his writings, indeed, in the aquatic way, remind us forcibly, from their fulness of detail, their life, and animation, of some of those stirring land scenes of Scott or James which have earned such world-wide reputation.

But it was not only as a chronicler that Mr. Cooper was so justly celebrated, for he united all the knowledge of the builder and the practical seaman with the powers of the historian—a combination rarely to be met with—and it would be difficult to say whether he excelled most when sailing a yacht off a lee shore in a gale of wind, under the most trying circumstances, or in writing an account of his adventure afterwards.

From that best of all tutors, experience, he knew thoroughly how to rig a yacht, and when afloat how to sail her, either in the exciting moments of a regatta, or during more peaceful periods of a cruise. The size that each halliard, whip, and tie should be, and the number of

strands that each rope should have, were as familiar to him as household words; while with the canvas that should be used for each sail, and with the way in which it should be cut, he was thoroughly conversant.

It is, therefore, with the fullest confidence we now reprint, in a more condensed form, a work which formerly appeared monthly in our Magazine, from the pen of so able an Author as Mr. Cooper, and the more so, that there has been a very generally expressed opinion among yachting men that a practical work of this kind is much needed, both as the means of teaching the young beginner as well as a book of reference to the older yachtsman; and we feel convinced that, however experienced the latter may be, he will find some information to be gleaned from so useful a treatise on all that concerns yachts and yachting as the book we now publish.

*London, September,* 1878.

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# YACHTS AND YACHTING.

## CHAPTER I.

"No ship that roams the ocean wide,
No bark that stems the rushing tide,
The daring cutter can outvie;
When storms and adverse winds prevail,
Still closer draws her vent'rous sail,
In the wind's eye.
* * * * * * *
Give her but once the weather-gage
She mocks the flying frigate's rage,
The baffled brig defies."

YACHTMANSHIP may be divided into two classes,—"Cruising" and "Racing:" we should endeavour to combine both, as properly speaking, there should not and division exist; but from the present unsettled and unsatisfactory state of the yachting laws, relative to "admeasurement of tonnage," innovations in build, canvas, and spars have crept in, which every true yachtsman ought to repudiate; and these innovations have given rise to the designations of "Racing Yachtsmen," and "Cruising Yachtsmen." The former appellation implying those who revel amidst huge spars, enormous spread of canvas, and piles of lead, wherewith to enable the straining craft to stand up to her canvas; whilst the latter denotes the quiet, comfort-loving rover of the sea, who loves sailing for sailing sake, is possessed of peculiar notions as to speed, and is singularly economical in the matter of setting canvas. Sailing a match he regards in the same light as setting a chimney on fire in order to have the fun of putting it out. The true yachtsman is however common to both, and it is to be hoped that 'ere long a satisfactory adjustment of the one grievance, and the modification or total abolition of the other, may reconstitute this glorious pastime on a well defined and permanent basis, and leave the Naval Architect free to construct vessels combining sea-

going properties with those of high speed; and their owners to sail them as their inclinations dictate, conscious of the fact, that the rover and cruiser has at length been combined.

There are two classes of yachts which, either as racers or cruisers, have become general favorites; namely yachts of 25 tons and 50 tons; these sizes experience has proved to be amply suitable for all purposes; not only in regard to accommodation, speed, and sea-going capabilities, but likewise the means of those who delight in yachting. Where extensive accommodation is required, and ladies' requirements are indispensible, we must ascend in the scale of tonnage considerably; we must then take into consideration the rig of yachts, and all experience tends to show that the cutter rig up to 50 or 60 tons is the best adapted for cruising; and beyond this tonnage the schooner rig has been found the most comfortable and economical.

To all whose ambition it is to become thorough cutter sailors and good yachtsmen, I would by all means recommend them to commence their career in a small craft, of say from 5 to 8 tons; but whatever tonnage she represents let her be rigged in every respect a perfect little cutter; two or three seasons knocking about in such a craft will lay the groundwork of sound practical knowledge, the tyro will learn the ropes,—the effect of the wind upon the different sails, the making and the taking in of sails, the art of steering, &c., almost imperceptibly, and what is of the last consequence towards attaining ultimate perfection, he will acquire "self confidence." The small craft, the "Mosquito Fleet" as they are designated, may be justly esteemed the nursery for our yachtsmen, the little five ton leads onward to the handy 25, the flying 50, and the stately schooner of 200 tons, and although we are prone to attach but little importance and slender respect to these tiny ocean butterflies, yet were it to come to a question of relative seamanship, many who smile at their apparent insignificance, as they pace the quarter decks of their floating palaces, might not be the worse of receiving a practical lesson from the hardy individual, who unites in his own proper person the duties of skipper and crew, cook, steward and all.

We will suppose in the first instance that the yachtsman builds, well then by all means let him devote as much personal attention to the craft whilst she is on the stocks, as his pursuits in life will admit of; no matter how high the reputation of the builder whom he selects may be, the owner's eye never harms the work, and irrespective of any other con-

sideration, no yachtsman can take rank for sound attainment, and scientific knowledge, unless he makes himself practically acquainted with, to use an apposite term, the "Anatomy" of a vessel. From the moment the lines are draughted, step by step he should follow the construction of the model; the line draught, should constitute his first study: the mould-loft floor will next occupy his attention, it may prove at first dull work, and the building slip monotonous, but a little attention thereto will amply repay him, we will gradually begin to reduce theory to practice, and that which has hitherto appeared involved in Algebraic mystery, and concealed beneath a cloud of puzzling technicalities will stand forth sufficiently unveiled to enable him to master, what otherwise might have remained to him, a sealed book.

It is not our purpose to enter into any learned disquisition on Naval Architecture, there are many very excellent works published thereupon, but it is much to be regretted that the useful knowledge contained therein is not conveyed in a somewhat simpler form, divested of that marvellous erudition, which induces us to regard the author with all that respect demanded by superior acquirements, yet when Mathematical verbosity becomes jumbled up with Algebraic prurіency, the fountain from whence we desire to quaff the simple draught, becomes nauseous from the luxuriance of science.

The primary considerations for the young yachtsman, when he has determined upon building, is the "length," the "beam," and the "draught" of water; these may very oftentimes, and with advantage, be left to the discretion of the builder; but as yachtsmen may not always be resident in the immediate vicinity of such favorites as Wanhill, Fife, Camper, Inman, Ratsey, White, Hatcher, *et sic de similibis de coeteris*, and yet may have excellent practical men in their neighbourhood, I propose giving them the measurements of various vessels, which I have picked up in my rambles, amongst whom the names of some celebrities will be observed, and if any yachtsmen will only take the trouble, when opportunity offers, of adding measurements that I have failed in obtaining, or correcting errors into which I may have unwittingly fallen, he will find the subjoined list of use, perhaps when he least anticipates.

1.—Wildfire, as cutter, 54 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 80 | 6 | Depth in hold | 9 | 0 |
| " of keel per tonnage | 64 | 2 | Draught of water aft | 9 | 0 |
| Breadth extreme | 13 | 9 | ,, " forward | 6 | 6 |

### 2.—Mosquito, cutter, 50 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 68 | 0 | Rake of stern post | 12 | 0 |
| Breadth extreme | 15 | 4 | Draught of water forward | 7 | 0 |
| Length from fore side of stem to aft side of stern-post, on deck | 63 | 0 | " " " aft | 10 | 6 |
| | | | Length of mast | 61 | 6 |
| | | | Diameter of ditto | 0 | 15¼ |

### 3.—Cymba, cutter, 58 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 65 | 0 | Rake of stern-post | 5 | 6 |
| Length from fore side of stem to aft side of stern-post, on deck | 58 | 0 | Length of mast from the deck | 48 | 0 |
| Length of keel | 53 | 0 | " topmast | 37 | 6 |
| Beam | 15 | 4 | " main boom | 54 | 0 |
| Draught of water aft | 10 | 0 | " gaff | 35 | 0 |
| " " forward | 5 | 6 | " bowsprit outside of stem | 33 | 0 |

### 4.—Volante, cutter, 50 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 74 | 6 | Beam | 15 | 0 |
| " of keel | 50 | 6 | | | |

### 5.—Viola, cutter, 25 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from the fore part of the stem to the after part of the stern-post | 42 | 5 | Beam | 12 | 0 |
| | | | Depth in hold amidships | 7 | 7 |

### 6.—Siren, cutter, 16 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post | 42 | 6 | Length of main boom | 33 | 10 |
| " over all | 46 | 5 | " gaff | 24 | 8 |
| Breadth extreme | 10 | 9 | " bowsprit | 29 | 4 |
| Length of mast from deck to head | 38 | 0 | " topmast | 26 | 11 |

### 7.—Champion, cutter, formerly 25, now 31 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post | 49 | 2 | Breadth extreme | 12 | 0 |
| " over all | 55 | 11 | Draught of water aft | 9 | 0 |
| | | | " " forward | 6 | 0 |

## 8.—Cynthia, cutter, 50 tons, o.m.

| | | | ft. | in. |
|---|---|---|---|---|
| Length over all | | | 67 | 8 |
| " from fore side of stem to aft side of stern-post. | | | 58 | 0 |
| Beam | | | 15 | 4 |
| Draught of water aft | | | 10 | 2 |
| Mast— | | | | |
| Step to partners | 9 | 1 | | |
| Partners to saddle | 2 | 5 | | |
| Depth of saddle | 0 | 3 | | |
| Saddle to hounds | 38 | 10 | | |
| Hounds to head | 9 | 0 | | |
| | | | 59 | 7 |
| Diameter of mast at partners | | | 1 | 3 |
| " " at hounds | | | 1 | 0¾ |
| " " at head | | | 0 | 11¼ |
| Racing bowsprit— | | | | |
| Heel to traveller sheave | 44 | 9 | | |
| Outside sheave | 3 | 7 | | |
| | | | 45 | 4 |
| Diameter of bowsprit at heel | | | 1 | 4½ |
| " " at end | | | 0 | 8¾ |

| | ft. | in. |
|---|---|---|
| Length of bowsprit outboard of stem | 35 | 0 |
| Distance between reefs of bowsprit, centre to centre | 2 | 8 |
| Diameter of sheave | 0 | 6½ |
| Width of ditto | 0 | 1¼ |
| Working bowsprit— | | |
| Heel to traveller sheave | 41 | 3 |
| Reefs of do., centre to centre | 3 | 5 |
| Mast head irons— | | |
| Hounds to main halliard block iron, centre | 2 | 1 |
| Main halliard block iron to lower peak block iron ditto | 1 | 10 |
| Lower peak block iron to middle block iron, ditto | 1 | 10 |
| Middle block iron to upper block iron, do | 1 | 9 |

## 9.—Water Wyvern, cutter, 42 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length from fore side of stem to aft side of stern-post | 55 | 0 |
| " over all | 61 | 0 |
| Breadth extreme | 14 | 4 |
| Length of mast from the deck | 48 | 0 |
| Diameter in partners | 1 | 2 |
| Length of boom | 48 | 0 |
| " gaff | 36 | 0 |
| " bowsprit | 40 | 4 |
| " topmast | 37 | 3 |
| Draught of water aft | 10 | 10 |
| " " forward | 7 | 0 |

## 10.—Enigma, cutter, 25 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 45 | 6 |
| Beam | 11 | 8 |

## 11.—Pauline, cutter, 35 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length from fore side of stem to aft side of stern-post on deck | 59 | 9 |
| Beam | 12 | 9 |

### 12.—Enchantress, cutter, 48 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post on deck | 62 | 0 | Beam | 14 | 9 |

### 13.—Tartar, cutter, 45 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 62 | 0 | Beam | 13 | 5 |

### 14.—Irish Lily, cutter, 80 tons, o.m.

| | ft. | in. | | | | ft. | in. |
|---|---|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 68 | 3 | Mast— | | | | |
| | | | Step to deck | 8 | 6 | | |
| | | | Deck to hounds | 46 | 0 | | |
| Beam | 16 | 4 | Mast head | 10 | 6 | | |
| | | | | | | 65 | 0 |

### 15.—Miranda, cutter and yawl, 94 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 70 | 8 | Beam | 17 | 10 |

### 16.—Jessica, cutter, 8 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 30 | 3 | Beam | 8 | 6 |

### 17.—Pet, cutter, 8 tons, o.m.—(The Baltic Pet.)

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 34 | 0 | Draught aft | 6 | 4 |
| Beam | 8 | 6 | | | |

### 18.—Zuleika, cutter, 20 tons, o.m,

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 49 | 3 | Beam | 10 | 6 |
| " from fore side of stem to aft side of sternpost, on deck | 43 | 3 | Draught of water aft | 7 | 0 |
| | | | " " forward | 6 | 0 |
| " of keel, aft side of stern-post to fore side of stem along the rabbet | 37 | 0 | Rake of stern-post from the perpendicular at the heel | 5 | 6 |

## 19.—Kelpie, cutter, 22 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post, on deck | 45 | 2 | Mast— | | |
| „ over all | 49 | 5 | Step to deck | 5 | 8 |
| Beam | 11 | 6 | Deck to saddle | 1 | 2 |
| Draught of water aft | 6 | 7 | Saddle to hounds | 33 | 2 |
| " " forward | 3 | 3½ | Hound to head | 6 | 10 |
| | | | | 46 | 10 |
| | | | Stepped from outside stem | 17 | 2 |

## 20.—Fidget, cutter (iron).

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 50 | 0 | Draught of water aft | 8 | 6 |
| Beam | 9 | 6 | Her keel is stated to weigh 25cwt. | | |

## 21.—Olivia, cutter, 25 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 45 | 7 | Beam | 10 | 0 |

## 22.—Nimrod, cutter, 40 tons.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 54 | 0 | Beam | 14 | 6 |

## 23.—Priestess, cutter, 18 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 35 | 5 | Beam | 10 | 0 |

## 24.—Coralie, cutter, 35 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post | 4 | 0 | Beam | 13 | 0 |

## 25.—Heroine, 85 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post | 52 | 0 | Racing spars— | | |
| Beam | 13 | 4 | Length of mast | 56 | 0 |
| Draught of water aft | 9 | 6 | Diameter in the partners | 1 | 1 |
| " " forward | 7 | 0 | " " hounds | 0 | 11 |
| Length of keel | 45 | 0 | Boom | 49 | 0 |
| Rake of stern-post | 7 | 0 | Gaff | 38 | 0 |
| | | | Bowsprit | 43 | 0 |
| | | | Topmast | 34 | 6 |

26.—Bonita, cutter, 30 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length from fore side of stem to aft side of stern-post | 54 | 0 | Beam | 11 | 8 |

27.—Lady Usher, 15 tons, o.m., Bermudian sloop.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 32 | 0 | Draught of water, aft | 8 | 0 |
| " of keel | 24 | 0 | Length of mast | 64 | 0 |
| Beam | 11 | 0 | Hoist of mainsail | 56 | 0 |

The model of this yacht was presented by Mr. Samuel Truscott, to the United Service Museum; this gentleman appears to have had great experience in the Bermudian sloops, and states that beating to windward nothing can compete with them; they come the nearest to the Yankee sloops of any rig, as they only carry two sails when on a wind, the only difference being that the Yankee sloop carries a gaff to her mainsail, and the Bermudian sloop's mainsail tapers to a peak; as of the Yankee, so of the Bermudian, they are by no means adapted to our waters, as they are unmanageable in a heavy sea. Mr. Truscott states that the Lady Usher laid up within 3¼ points when close hauled on a wind, and that she has been known to sail three miles and a half dead to windward in half-an-hour. Mr. Truscott had one of these Bermudian sloops at Plymouth, called the Annie, of 16 tons: she drew 9ft. aft and 4ft. 10in. forward, and he says she laid up within three points of the wind.

28.—Maria, American sloop; this vessel is fitted with centre-boards, and 170 tons, New York Custom House tonnage; 187 tons by displacement as per Mr. F. F. Palmer's draught, published by Mr. N. Currier, Nassau Street, New York.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length on deck | 110 | 0 | Length of gaff | 50 | 0 |
| Beam | 26 | 6 | " bowsprit outboard | 27 | 0 |
| Depth of hold | 8 | 3 | " jib-boom | 70 | 0 |
| Length of mast | 91 | 0 | Diameter of boom (hollow) | 2 | 2 |
| " boom | 95 | 0 | " bowsprit (ditto) | 2 | 0 |

As many of my readers will doubless ask, What is the meaning of a hollow boom or bowsprit? The best answer I can give them is that of an extract from a letter of Messrs. Fish and Morton, of New York, yacht builders and manufacturers of hollow spars.

"The Maria's boom is 100ft long, and cost about 600 dollars; it is built with staves like a barrel. We made a boom for the Ultra 74ft. long, 15in. diameter in the slings, 8in. on the ends, it was shaped like a cigar: we got it out of a solid stick of white pine (shaping it out of the solid to the size required), we then sawed it lengthwise through the centre, and hollowed it out, leaving the shell 2in. thick all round; after it had dried out well we brought it together and banded it with thin broad iron bands, about 5ft. apart; the ends of the bands came together (with mortice loops), and with iron wedges we set them up very tight. This boom cost about 100 dollars all complete, and made a very light strong boom; we bored inch auger holes through the boom in the seams, within six inches of every other band, and drove plugs in the holes to prevent one part of the boom shifting by the other if the boom bent; we think a hollow boom is far superior to a solid one."

The above extract I call the particular attention of my readers to.

29.—Una, American sloop, 60 tons, New York Custom House measurement.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length on deck | 64 | 0 | Hoist of mainsail | 49 | 0 |
| " of mast | 60 | 0 | Boomkin, outboard | 19 | 0 |
| Rake of mast | 4 | 0 | Distance from stem to mast | 20 | 0 |
| Length of boom | 56 | 0 | Area of mainsail 2,312 sq. feet | | |
| " gaff | 28 | 0 | " staysail 940 " | | |

30.—Sylvie, American sloop, fitted with centre-board, 105 tons, New York Custom House Tonnage, 191 tons, British o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 80 | 0 | Length of boom | 72 | 0 |
| " from aft side of stern-post to fore side of stem | 74 | 0 | From mast to end of boomkin | 50 | 0 |
| Depth of hold | 6 | 9 | Jib-boom outside of boomkin | 18 | 0 |
| Beam | 24 | 0 | Length of centre-board | 15 | 0 |
| Height of saloon | 6 | 8 | Can be lowered | 7 | 0 |
| Draught of water, aft | 5 | 0 | | | |
| Length of mast | 82 | 0 | | | |

There is the same draught of water, viz. 5ft, along her keel for 47ft. after which she tapers up to nothing at the cut water. Her stern-post is upright.

Her state saloon, furnished in carved rosewood, and maroon coloured velvet; polished walnut wood chairs with cane seatings. Her saloon state cabin, lined with blue and white satin, and the furniture thereof polished rosewood, and blue and white satin.

### 81.—America, schooner, 171 tons, American, 208 o.m. British.

| | ft. | in. |
|---|---|---|
| Length over all | 100 | 0 |
| " from fore side of stem to aft side of stern-post, on deck | 94 | 0 |
| Draught of water aft | 10 | 0 |
| " " forward | 5 | 6 |
| Moulded beam | 23 | 0 |
| Depth in hold | 9 | 0 |
| Length of mainmast | 81 | 0 |
| Length of main-boom | 58 | 0 |
| " gaff | 26 | 0 |
| " foremast | 79 | 5 |
| " fore-gaff | 25 | 0 |
| Centre of foremast from stem | 28 | 6 |
| " mainmast from aft of stern-post | 35 | 6 |

Her saloons were furnished in carved rosewood, polished rosewood, polished American walnut wood, and green silk velvet.

### 82.—Sverige, Swedish schooner, 280 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length over all | 111 | 0 |
| Extreme breadth | 25 | 0 |
| Depth of hold—deck to keelson | 11 | 0 |
| Draught of water aft | 12 | 0 |
| " " forward | 7 | 6 |
| Length of mainmast | 92 | 6 |
| " " foremast | 87 | 6 |
| Length of main-topmast | 18 | 0 |
| " fore-topmast | 18 | 0 |
| " main-boom | 58 | 6 |
| " main-gaff | 30 | 0 |
| " fore-gaff | 30 | 0 |
| " bowsprit, out-board | 8 | 0 |

37ft. English is equal to 38ft. Swedish.

### 83,—Mary Taylor, American Pilot schooner.

| | | | ft. | in. |
|---|---|---|---|---|
| Length over all | | | 69 | 0 |
| " on deck | | | 63 | 0 |
| " on load water-line—sheer plan | | | 64 | 0 |
| Beam | | | 18 | 0 |
| Draught of water aft | | | 8 | 0 |
| " " forward. | | | 4 | 6 |
| Foremast— | | | | |
| Deck to saddle | 1 | 6 | | |
| Saddle to hound | 45 | 3 | | |
| Hounds to head. | 9 | 0 | | |
| | | | 56 | 0 |
| Mainmast— | | | | |
| Deck to saddle | 3 | 6 | | |
| Saddle to hounds | 46 | 6 | | |
| Hounds to head | 5 | 6 | | |
| | | | 55 | 6 |
| Length of main-topmast | | | 21 | 0 |
| " main-gaff | | | 19 | 0 |
| " main-boom | | | 34 | 0 |
| " fore-gaff | | | 19 | 0 |
| Hoist of mainsail | | | 41 | 0 |
| " foresail | | | 43 | 0 |
| Length of foot of foresail | | | 28 | 0 |
| Hoist of staysail | | | 44 | 6 |
| Length of ditto on the foot | | | 30 | 0 |
| Bowsprit-outboard | | | 13 | 6 |

### 84.—Moses H. Grinnell, American Pilot schooner.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 73 | 6 | Draught of water forward | 2 | 6 |
| " on deck | 71 | 6 | Centre of foremast from knight heads | 19 | 6 |
| " on load-water line—sheer plan | 67 | 0 | " mainmast from centre of foremast | 25 | 3 |
| Beam | 18 | 6 | Upright stern-post. | | |
| Draught of water aft | 6 | 6 | | | |

### 85.—Gazette, American Pilot boat.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length on deck | 62 | 0 | Drag—or excess of draught of water aft over the draught of water forward | 4 | 0 |
| " keel | 52 | 0 | Rake of stern-post | 4 | 6 |
| Beam | 17 | 6 | | | |
| Depth in hold | 7 | 0 | | | |

Built in 1826, bow quite full in form.—Tonnage, carpenter's measurement, 75.

### 86.—Christian Berg, American Pilot boat.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length on deck | 73 | 0 | Drag, or excess of draught of water aft over the draught of water forward | 3 | 6 |
| " keel | 66 | 0 | Rake of stern-post | 1 | 0 |
| Beam | 18 | 0 | | | |
| Depth | 7 | 9 | | | |

This vessel was built in 1851; her bow is long and fine; her tonnage builder's measurement is 95.

### 87.—Victorine, sloop, 98 tons.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all from taffrail to knight heads | 74 | 0 | Beam | 24 | 0 |
| Projections of stem and figure head beyond knight heads | 6 | 0 | Draught of water aft | 5 | 0 |
| Length from knight heads to aft side of stern-post on deck | 68 | 0 | " " forward | 5 | 0 |
| " on load water-line—sheer plan | 65 | 0 | Length of centre-board | 19 | 0 |
| Length of keel | 60 | 0 | Can be lowered | 8 | 0 |
| | | | Centre of mast from knight heads | 18 | 6 |
| | | | Rake of stern-post | 2 | 0 |

This is a celebrated American centre-board sloop, said to be the fastest trading on the river Hudson.

## 38.—Flying Cloud, schooner, 75 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length | 74 | 9 |
| Beam | 15 | 5 |
| Depth | 9 | 5½ |
| Draught aft | 9 | 9 |
| " forward | 4 | 6 |
| Mainmast | 52 | 6 |
| Hoist of mainsail | 40 | 6 |
| Topmast fid to sheave | 27 | 6 |
| Topsail yard, extreme | 21 | 0 |
| Balloon ditto | 38 | 0 |
| Boom | 45 | 6 |
| Gaff | 27 | 6 |
| Foremast | 49 | 8 |
| Hoist of foresail | 38 | 6 |
| Topmast fid to sheave | 24 | 6 |
| Topsail yard, extreme | 18 | 6 |
| Balloon ditto | 36 | 0 |
| Gaff | 21 | 0 |
| Bowsprit, knightheads to end | 23 | 6 |
| Squaresail yard, extreme | 45 | 6 |
| Square-topsail | 28 | 0 |
| Taffrail to centre of mainmast | 36 | 0 |
| Centre of mainmast to centre of foremast | 23 | 6 |
| Centre of foremast to knight heads | 24 | 0 |

## 39.—Claymore, schooner, 145 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length from fore side stem to aft side of stern-post | 95 | 6 |
| Length over all | 10 | 6 |
| Extreme breadth | 18 | 6 |

## 40.—Gloriana, schooner, 184 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length on deck | 77 | 6 |
| Beam | 19 | 7 |

## 41.—Rosalind, schooner, 100 tons, o.m.

| | ft. | in. |
|---|---|---|
| Length over all, not including scroll figure head | 85 | 6 |
| Length from aft side of stern-post to fore side stem | 76 | 6 |
| Projection of scroll figure head | 5 | 6 |
| Beam | 17 | 8 |
| Draught of water aft | 10 | 6 |
| " " forward | 6 | 0 |
| Centre of foremast from fore part of stem, on deck | 21 | 6 |
| Foremast from deck to hounds | 46 | 0 |
| Fore-topmast from the fid to sheave | 17 | 6 |
| Fore-gaff, extreme length | 19 | 6 |
| Bowsprit, outboard of knight heads | 10 | 0 |
| Centre of mainmast from centre of foremast, on deck | 24 | 0 |
| Rake of stern-post from perpendicular dropped from deck | 5 | 6 |
| Mainmast from deck to hounds | 49 | 0 |
| Main-topmast from the fid sheave | 17 | 6 |
| Mainboom, extreme | 48 | 0 |
| Main gaff | 22 | 10 |
| Square yard, extreme | 46 | 0 |
| Square topsail yard ditto | 23 | 0 |

### 41.—St. Ursula, schooner, 180 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all to knight heads | 107 | 0 | Rake of stern post from perpendicular dropped from deck | 3 | 3 |
| Length from aft side of stern-post to fore side of stem under knight heads, on deck | 94 | 0 | Dength of mainmast | 83 | 0 |
| Beam | 22 | 0 | Diameter of ditto in partners | 1 | 11 |
| Draught of water aft | 12 | 0 | Projection of scroll figure head from knight heads | 7 | 0 |
| " " forward | 6 | 0 | | | |

### 42.—Zara, schooner, 280 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length | 110 | 0 | Length of main-gaff | 28 | 0 |
| Beam | 24 | 3 | " foremost above deck | 66 | 9 |
| Depth | 12 | 3 | " fore-gaff | 25 | 0 |
| Length of mainmast above the deck | 78 | 0 | Bowsprit outside | 20 | 0 |
| Length of main-boom | 60 | 0 | Jib-boom | 28 | 0 |

### 43.—Aurora Borealis, Swedish schooner, 250 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 120 | 0 | Depth in hold | 8 | 0 |
| " on deck | 112 | 0 | Draught of water aft | 10 | 6 |
| Beam | 22 | 10 | " " forward | 8 | 6 |

### 44.—Mayfly, schooner, 115 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 101 | 0 | Beam | 17 | 3 |
| " of keel | 83 | 0 | Draught of water aft | 9 | 4 |
| " on the deck | 87 | 2 | " " forward | 6 | 6 |

### 45.—Phantasy, schooner, 20 tons, o.m.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 50 | 0 | Length of mainmast | 36 | 0 |
| " keel | 35 | 0 | " foremast | 34 | 0 |
| Beam | 11 | 6 | Diameter in the partners | 0 | 10½ |
| Draught of water aft | 8 | 0 | " " rigging | 0 | 8 |
| " " forward | 5 | 0 | | | |

[The dimensions of many other yachts are given at the end of the work.]

## CHAPTER II.

> "'Thus,' said he, 'will we build this ship,
> Lay square the blocks upon the slip,
> And follow well this plan of mine.
> Choose the timbers with greatest care;
> Of all that is unsound beware;
> For only what is sound and strong
> To this vessel shall belong.
> * * * * * *
> "Build me straight, O worthy master,
> Stanch and strong, a goodly vessel,
> That shall laugh at all disaster
> And with wave and whirlwind wrestle!"—LONGFELLOW.

HAVING determined upon the length, the beam, and the draught of water, the next thing to be done is to reduce these dimensions into shape, ; and therefore, if capable of doing so, construct your model yourself, if not, be present when the builder is constructing it, and learn from him how to do so.

Models to the scale of three-eighths, three-fourths, and one inch, are the best size, as they afford you a more just conception of the shapes of a vessel than a model constructed on a smaller scale: in fact the larger the scale you can construct your model on, the less liable will you be to error in building the vessel herself. The yachtsman will do well to remember—

FIRSTLY.—That length gives speed;

SECONDLY.—That beam gives power and stability under canvas; and

THIRDLY.—That the draught of water gives stability and lateral resistance.

But at the same time any one, or the whole three, may be overdone, and here it is that reference to the measurements of known and tried yachts becomes of the very greatest importance to the novice.

Of late years length has very much increased, and it is hard to say if we have yet arrived at proper conclusions as to the extent that length may be carried. Since the construction of the yachts whose dimensions have been given, others of greater length in proportion to beam have been built, such

as Fiona, Glance, Kilmeny, Norman, and others including the lengthened Volante all celebrated vessels, and five times their beam one and all of which have proved themselves in many a hard fight undeniable good in running and going to windward. The Mosquito is the only one of the old stamp of about four times her beam which can hold her own with the longer craft.

A vessel that has too much beam involves one of the greatest principles in the construction of fast vessels, and that is displacement. A man endeavouring to get through a crowd of people will do so much easier by advancing sideways, than he will if he walks right square through it. Let us suppose the crowd to represent the opposing globules of water. This familiar occurrence of every day life, is probably as apposite an illustration as I could give, as the greater the beam the greater will be the displacement and consequently the greater will be the resistance to the vessel's passage through the water. She will also be an uneasy vessel in a seaway, because she cannot have length of floor, and in running or reaching her speed will be inconsiderable, and the only good quality she will be found to possess will be that of carrying canvas, without however realizing its effect.

A vessel that draws too much water, although being otherwise properly proportioned as to beam and length, will suffer immeasurably from the laws regulating the displacement of fluids; as it is a fixed principle that the deeper you descend the denser becomes the resistance: she will no doubt have great stability in blowing weather, but in calms with a rolling sea, she will be very heavy in her spars, sails and rigging: and above all she will place the cruising yachtsman very often in the most awkward dilemmas, from the impossibility of entering very many harbours where a light or medium draught of water is essential.

As I have said before, reference to the "length," "beam," and "draught," of water, of known and tried vessels, contrasted with the requirements desired, will be the best guide for the young yachtsman.

A vessel of good length, a fair medium beam, a very slightly raked stern-post, which will enable you to obtain a good length of floor, on a light draught of water;—a draught of water, of say, (according to tonnage) from 8 to 10ft. aft. and half either draught forward; a very fine entrance, with but extremly little hollow, the bows flaring well out from the load water line; a clean but by no means a lean run aft; the quarters rounded well up, the stern planking running up to the covering board, so as to avoid any unnecessary drag aft; a full round side, forefoot well rounded up; the main beam rather aft of the measured centre,

a shoal mast, a good peaked mainsail, a short bowsprit, and small head canvas, and the young yachtsman will find that he will not be far from the right track.

So much has been said and written upon the subject of the "upright" and "raked" stern-post in cutter yachts, and by so many more able authorities, that I feel it would be presumptuous in me to offer an opinion on the matter; yet I cannot refrain from expressing my belief that many good qualities are secured to a vessel by having her built with an upright stern-post, and my reasons for believing so are these,—by having an upright stern-post you can so place your midship section as to secure a fine and easy entrance to the vessel, you obtain a longer floor, easier after lines, sufficient lateral resistance upon a light draught of water, the vessel will steer easier, will be faster running and reaching, equally as good on a wind, and when hove-to will rise easily and steadily to the sea, and not yaw about half so wildly when falling off or coming up; and above all an upright stern-post enables you to have a light fore-foot, whereby instead of carrying an enormous bowsprit, with proportionate canvas, in order to keep the vessel from griping or running up into the wind, you gain a light spar and handy lifting sails, and the vessel will be *going* where she *looks*, and that *is* dead to windward. This belief is not based upon pedantic theory, but upon simple and practical experience. There is one advantage in a raking stern-post and that is that the vessel so formed is quicker in stays, as it stands to reason that you can turn a short board round in the water quicker than you can a long one, and as I have before observed the lower you are in the water so much the heavier the water is to move, so the bottom part of the vessel is more difficult to turn than the top, and the shorter the keel the easier to turn. Where a vessel is in the habit of frequenting narrow waters a certain rake; say of four in eight is indispensible.

It is greatly to be regretted that such extreme secrecy, in fact, I may broadly and at once characterize it as selfishness, exists on the part of both builders and owners throughout the United Kingdom, as to the lines, the spar plans, and sail draughts of vessels; and to this may be attributed the mystery which even at the present moment enshrouds yacht building. The rule of the New York Yacht Club on this subject deserves to be printed in letters of gold, and hung up in every Royal Yacht Club-house in Great Britain, it says:—

"THE MODEL OF EACH YACHT SHALL BE DEPOSITED WITH THE

RECORDING SECRETARY BEFORE SHE CAN ENTER FOR THE ANNUAL REGATTA. THE MODEL SHALL BE THE PROPERTY OF THE CLUB."

Why is it that we have no such rule general amongst us? It would be a most beneficial one; and what could be more thoroughly conducive to the interests of yachting, and the instruction of yachtsmen themselves, than having a large apartment in each club-house specially devoted to a collection of the models of the best known and tried vessels, made to scale, affording at once a satisfactory means of reference, as to the form of the hull, dimensions of the spars, and proportions of canvas.

I am however digressing somewhat;—we must now suppose that the model is all right, has been decided upon, and that the builder has furnished his estimate (gentle yachtsman do nothing in such matters without an estimate) for building. The estimate may be decided under two heads, either the builder may contract for the hull and spars alone; or he may contract for hull, spars, rigging, canvas, coppering, internal fittings, &c. In the former case the estimate will range at from £9 to £10, in the latter from £20 to £30 per ton, or more according to the ballast he puts in her, for of course if he ballast his vessel entirely of lead it will come to considerably more than this estimate. If the yachtsman be of large means and luxurious habits, it would be *de trop* to even notice the progress of a yacht, until like a well appointed carriage she is turned out ready to step into; but to the man who wants to make himself practically acquainted with the details of building, fitting, and expenditure, I say, no matter which estimate is adopted, see how each part of it is carried out. If he has picked up any experience at all, I would by all means recommend a contract for the hull and spars alone. If she is to be coppered, agree at once as to workmanship, and purchase the copper according to the market price. Then follow the plumber, the cabinet-maker, the upholsterer, the rope-maker, the block-maker, the sail-maker, and though last not least, the ship-chandler.

The young yachtsman must not be frightened at the array of tradesmen I have marshalled forth, his own prudence and judgment must guide him as to the amount he chooses to expend under each head; but my principal object in bringing under consideration the different trades, that are called into operation by the building of a yacht, is to show that in case the estimate embracing the entire completion of a yacht be adopted, that the builder having to engage all these parties to work for him, must of course put an additional per centage on their charges to him, and con-

sequently the price per ton is laid on accordingly. It is this very high price that deters many men from building yachts, upon the principle that "fools build houses for wise men to live in;" but if such a proverb were acted up to, we should have no progress made at all in yacht building. I do not mean to impute any improper motives to our talented and respectable yacht builders, but this I will say, that if the builders in general would curtail the expenditure a "leetle," it would be for their own interest, as more vessels would be built. There are some of our builders whom I dare say would not waste their time in building for any man who did not give them *carte blanche* in turning her off the stocks.

Now this is all very well and legitimate in its way; men who can afford thousands as easily as thanks, have a right to pay liberally for the services of accomplished yacht builders and artisans, it is only by the rich man's profuse expenditure that his fastidious tastes can be gratified; and it is but just and proper that talent, when adapting its resources to whim and caprice, should be adequately remunerated. If the evil, as effecting the general interests of yachtsmen, rested here, it would be enough; but it does not, for at every little outport station where a shipwright exercises his calling, the moment a yacht to be built is talked of, tales of mighty sums lavished upon favorite builders are in every mechanic's mouth—the yachtsman is regarded as "fair game;" every difficulty that can draw forth money is magnified; and many a yachtsman desirous of benefitting some particular locality, has had cause to abjure philanthropy and new yachts, and to exclaim ever after,—"The man that builds is a fool!" I am happy however to know there are many exceptions, and caution yachtsmen that if they are mulcted a bit it is their own fault: a look ahead will often save them a look at their purses, and if they will only exercise their own clear brains a little more actively, think for themselves, and not allow some pet dandy skipper to think for them, they may appear to be "penny wise," but they will not be found "pound foolish."

I find I must control my digressive propensities. Having regard to the first expenditure in producing a yacht, let her be of what tonnage she may, the most advisable plan to adopt is to complete your hull, your rigging, and your sails the first year; spare neither trouble, time, nor legitimate expense in carrying out these three items; any one of them imperfectly carried out, and you might just as profitably have scattered your money on the first sandbank you encounter, carry out these well and ultimately you will attain perfection; the expensive internal fittings,

luxuriously cushioned sofas, gorgeous carpets, and silken hangings, will follow all in good time; but if you cannot sleep as soundly in a hammock, and mess off an honest deal table, the less you say about being a yachtsman the better, let "plain comfort," but "conspicuous cleanliness," be your motto, and remember that a good sailor must make his appearance through the hawse-pipes before he can be entitled to look through the cabin windows. The lay of a rope, the texture of canvas, or the grain of a plank is more fitting knowledge for an aspirant to salt sea fame, than the "pile" of velvet, the brilliancy of satin, or the polish of rosewood: leave all such "superior" information for the acquirement of "kid gloved" long "telescoped" mariners; never identify yourself with such feather-bed bipeds; the tiller in their hands of a dark stormy night would be the refinement of vulgarity, an identification with the common sailor too repulsive to be entertained by their sensitive imaginations. No, no, youthful brother of mine, read this little extract from the pen of that soul of poetry, Eliza Cook, and let it arouse in thee a noble spirit of emulation:—

"Now, now, the night-breeze freshens fast, the green waves gather strength,
The heavy mainsail firmly swells the pennon shows its length;
Our boat is jumping in the tide—quick, let her hawser slip;
Though but a tiny thing, she'll live beside a giant ship.
Away, away! what nectar spray she flings about her bow,
What diamonds flash in every splash that drips upon my brow;
She knows she bears a soul that dares and loves the dark rough sea;
More sail! I cry, let, let her fly; this is the hour for me."

We are now supposed to be in the building yard; and as it may prove a useful guide, I will here give the sizes, or, technically speaking, the scantlings, for the hull of a 50-ton cutter, and for a 25-ton cutter.

## A Fifty Ton Cutter.

The Frame:—

| | | |
|---|---|---|
| Keel and deadwoods of American elm | sided 7in. | |
| Stem of oak | " 7in. | Moulded 13in. |
| Stern post of oak | " 7in. | " 13in. |
| Floor timbers of oak | " 6in. | " 10in. |
| First futtocks of oak | " 5in. | " 5½in. |
| Second futtocks of oak | " 5in. | " 5in. |
| Top timbers of oak | " 4in. | " 4in. |
| Deck beams of oak and pine alternately | | 5in. by 5in. |
| Stringers of red pine, each in one length | | 5in. by 7in. |
| Stern timbers of oak | | 4in. by 6in. |
| Room and space | | 2ft. |
| In the clear | | 13in. |

PLANKING :—

| | |
|---|---|
| The covering boards of oak or American elm ........................ | 2¼in. thick. |
| Binding strake of oak or American elm .................................. | 2¼in. thick. |
| Bends of oak or American elm .................................................. | 3in. thick. |
| From the bends to the bilge-pine ............................................ | 2in. thick. |
| From the bilge down, including garboard strake elm ............... | 2in. thick. |
| Deck plank, clean yellow pine (to be tapered aft and forward) | 3½in. by 2¼in. |

DECK WORK :—

| | |
|---|---|
| Bulwark stanchions of oak (to be neatly moulded) ............... | 4in. by 3¼in. |
| Rails, clean American elm " " ............... | 4¼in. by 2¾in. |
| The wash strake of pine " " ............... | 5in. by 1¼in. |
| Bulwark sheeting, pine ...................................................... | ¾in. thick. |

Bowsprit bitts, mast bitts, and belaying pin racks of oak.

Cleats, kevels, coamings of skylights, companion and hatchways, oak or mahogany.

FASTENINGS :—

The keel, deadwoods, and floorings timbers to be fastened with the very best ⅞in. round iron.

The frame timbers to be bolted with the very best ⅞in. square iron.

The plank fastenings to be of 6in. Muntz's metal spikes, the butts of the planks to be copper bolted, and tree-nailed, and sister bolts of ⅝in. copper through the centre of the plank, and the timber next thereto.

The stringers to be fastened, with ⅝in. copper rod, rivetted through every timber.

The deck planks to be fastened with Muntz's metal nails and dowels, or with galvanized iron nails and dowels, or with oak dowels and screws.

The bitts, belaying pin racks, cleats, and kevels, to be fastened with ⅝in. copper rod.

The bilge planks to be thorough bolted with ¾in. copper rod, rivetted on the inside.

The stern transom to be fastened with ⅝in. copper rod, rivetted.

All joints should be well coated with bright varnish before they are put together.

It is an excellent plan to run two bilge strakes fore and aft, inside, of red pine, 6in. by 8in., to be bolted and rivetted through each timber and the bilge plank, with ⅝in. copper rod.

It is most advisable to have a vessel kneed, and although many object to knees, as stiffening a yacht too much, yet experience proves that such is not the case, as one of the fastest 50-ton cutters now afloat is kneed all though her deck beams, with oak knees. Knees and the pine bilge strakes above alluded to make a first-rate strong job in a racing or cruising yacht.

The knees to be bolted through the deck beams, stringers, top-strakes and binding stroke, with ⅝in. copper rod and rivetted.

## A Twenty-Five Ton Cutter.

**The Frame:—**

| | | | | |
|---|---|---|---|---|
| Keel and dead-wood of American elm | sided | 5in. | | |
| Stem of oak | " | 5in. | Moulded | 10in. |
| Stern-post of oak | " | 5in. | " | 10in. |
| The flooring timbers of oak | " | 4in. | " | 7in. |
| The first futtocks of oak | " | 3½in. | " | 4in. |
| The second futtocks of oak | " | 3in. | " | 3in. |
| The top timbers of oak | " | 3in. | " | 3in. |

| | |
|---|---|
| The deck beams of oak and pine alternately | 3½in. by 3½in. |
| The stringers of red pine in one length | 3½in. by 5in. |
| The stern timbers of oak | 3in. by 4in. |
| Room and space | 2ft. |
| In the clear | 15in. |

**Planking:—**

| | |
|---|---|
| The covering boards of oak or American elm | 1¾in. thick. |
| The binding strake " " | 1¾in. " |
| The bends " " | 2¼in. " |
| From the bends to the bilge pine | 1¾in. " |
| From the bilge down, including garboard strake, elm | 1¾in. " |
| The deck planks to be of clean yellow pine, in one length each, and tapered fore and aft | 3½in. by 1¾in. |

**Deck Work:—**

| | |
|---|---|
| The bulwark stanchions of oak (to be neatly moulded) | 3in. by 2¾in. |
| The rails, clean American elm " " | 4in. by 1¼in. |
| The wash strake of pine " " | 4in. by 1in. |
| The bulwark sheeting, pine " " | ½in. thick. |

The cleats, kevels, and belaying pin racks of oak.
Bowsprit bitts, and mast bitts of oak.
Coamings of companion, skylight and hatchways of oak.

**Fastenings:—**

The keel, dead-woods, and flooring timbers, to be fastened with the best ¾in. round iron.

The frame timbers to be bolted with the best 3in. square iron.

The plank fastenings to be 4in. Muntz's metal spikes, each butt to have a copper bolt of ½in. copper rod through the centre of the plank in the timber next thereto.

The stringers to be bolted through every timber, and through the binding strake, with ½in. copper rod, rivetted.

All joints to be well coated with bright varnish before they are put together.

Bilge strakes of red pine 4in. by 2½in. to be bolted and rivetted, fore and aft through every timber, and the bilge planks.

Oak deck knees to be bolted through the deck beams, stringers, top timbers, and binding strakes, with ½in. copper rod bolts rivetted.

As almost every builder differs somewhat from his brother chip, not

only in the scantlings, but in the mode of framing and planking a vessel, I of course do not presume to say that the above scantlings, planking or fastenings, are those which are used by every yacht builder; but I think they will be found sufficiently accurate to form a basis for the judgment of the yachtsman.

There is one point to which I would beg to draw the particular attention of yachtsmen with regard to the framing and planking of a yacht: I was first struck by it upon reading Lieut. Griffith's work on Naval Architecture, for assuredly a principle that is applicable to a ship, is proportionately applicable to a yacht. In Griffith's Treatise (a work by-the-bye which should be in the library of every nautical man), he draws particular attention to the fact that it is not necessary to the attainment of the greatest strength that the framing and planking should be of the same scantling at the ends of a vessel as at the midship section. Now, it strikes me that this principle might, with immense advantage, be applied to the frame work and planking of a yacht. The deadwoods of a yacht extend further and rise higher than in any other vessel, and being conducive to strength; consequently a yacht is peculiarly adapted to the development of this principle, it may be applied in two ways,—first, the siding of the forward and after timbers may be reduced; but this plan is open to objection, as if the siding be reduced, "*cæteris paribus*," you must likewise reduce the size of your fastenings, otherwise you weaken the timbers in too great a ratio. The second method, and what to me appears most feasible, is by increasing the room and space, or to divest it of its technicality, increasing the distance between the timbers of the vessel very gradually, commencing at the midship section; thus with the same scantling of timbers, and increasing the distance between them forward and aft, you obtain an equally strong, if not a stronger, vessel; livelier and more buoyant; for useless weight at either end of a vessel not only materially detracts from her strength, but deteriorates her speed most seriously. It must likewise be borne in mind that a sharp vessel like a yacht is not so equally supported at the stem and stern by the water as she is at her broadest or midship section, and therefore that attention to economy in weight at these points, consonant with due strength, must largely increase a vessel's good qualities.

Iron fastenings are the best for deadwoods and frame timbers, inasmuch as it is impossible to drive copper rod, unless it be uselessly stout, such a length through the deadwoods, in consequence of its softness;

neither can copper rod be driven so tight and firmly home as the iron rod besides which it is not necessary that these fastenings should be copper; and iron rod suiting all purposes best; is likewise very much less expensive.

The iron rod should be "round" for the deadwood fastenings, as the round rod drives water tight; but square rod is the best for the timber fastenings, as being less likely to split the timber, more or less of which may happen to be grain cut, and it holds light scantlings proportionately better and firmer than the round iron.

## CHAPTER III.

"Day by day the vessel grew,
With timbers fashioned strong and true,
Stemson and keelson and sternson knee,
Till, framed with perfect symmetry,
A skeleton ship rose up to view!—
And around the bows and along the side,
The heavy hammers and mallets plied
Till after many a week, at length,
Wonderful for form and strength,
Sublime in its enormous bulk,
Loomed aloft the shadowy hulk!"

Be particular, if your selection of timber will permit of doing so, in having your keel all in one length; in a 25-ton vessel there cannot be any difficulty. If you must have your keel in two lengths it involves the necessity of a scarph, or joining; in such case the method in which the scarph or joining is made, becomes a matter of consequence, as it seriously involves the strength of the vessel. The usual method of joining the pieces of a keel is by what is called a "table scarph," of which I have given a rough sketch. Fig. 1 represents a vertical view of the two pieces of the keel prepared for joining. Fig. 2 represents a horizontal view of the same, with the faces of the scarph laid uppermost. Fig. 3 represents the two pieces joined, with two flooring timbers bolted; the bolts of the timbers taking the scarph, and extra bolts at the ends. The length of a scarph will be regulated by the distance of the timbers asunder. This sketch is not drawn to any scale, neither have I shown the keelson, Fig. 2, which is laid over the timbers, and bolted through them and the keel.

A A—The two pieces of the keel to be scarphed or jointed.
B B—The length of the scarph.
C C—The raised pieces or tenons worked out of the solid timber.
D D—The grooves, or mortices, hollowed out to receive the tenons.
E E—The two flooring timbers, the distance between which regulates the length of a scarph.
F F—Bolts which are driven through the keelson, flooring timbers, and keel, passing through the tenons of the scarph.
G G—Bolts through the ends of the scarph.

Plate 1.

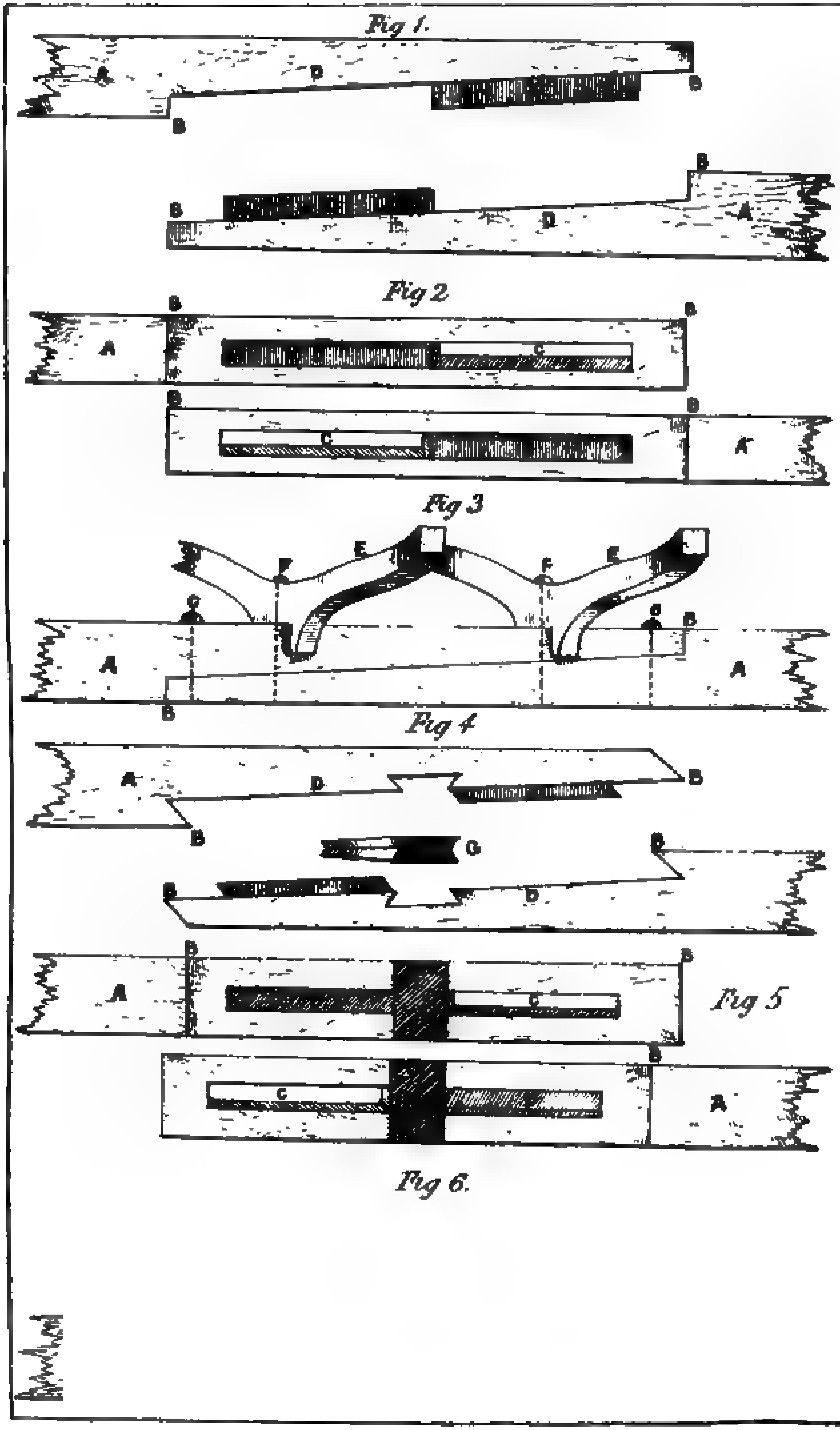



Fig 1.
Fig 2
Fig 3
Fig 4
Fig 5
Fig 6.

I would call attention to the following shape of scarph, which may be designated the "wedged table scarph" (see Figs. 4 & 5), it is undoubtedly more troublesome, but if neatly fitted in all parts, and put together with "white lead," ground fine with coach varnish, it will last till the crack of doom. The grooved wedge G, and the shapes of the ends of the "scarph."

"Tenons" and "Mortises" (see Fig. 6), constitutes the only difference in the principle of construction between it and a common "table scarph;" but I think a glance at the sketch will at once show the difference in strength, neither will it require bolts at the ends of the scarph; and one thing the yachtsman should bear in mind, that the fewer fastenings he can have, the better, as the less he weakens the framing or planking of his vessel; let each individual fastening be good of its kind, applied with judgment, and finished in its details. Apropos of fastenings, those driven through the keelson, flooring timbers, and keel, require a few observations. I have before stated that iron fastenings will, and have been found to answer equally well, if not much better than copper bolt fastenings for the frame and deadwoods; but if these be driven through the keel, as keel, timber, and keel bolts, and riveted, there is a chance of galvanic action taking place between the copper sheathing of the vessel and the bolt, the result of which would be that the iron bolt would become corroded, the ring over which it was riveted would drop off, and the fastening would become in a measure insecure; the usual mode of rivetting copper or iron bolts, is by driving a flat ring of metal over the end of the bolt, and then beating it out over the ring which thus forms the head. (See Fig. 7.)

On the principle that anything that is worth doing at all, is worth doing well, were I building a vessel for myself, I would, for the keel fastenings, have regularly made headed bolts—with screws and nuts (see Fig. 8); having bored for these through the keel, I would countersink the holes, on the underside of the keel for not less than three inches, so as to admit of the nut being screwed up, then measuring exactly the length of bolt required, cut the extra length off, and with a key wrench made thus (see Fig. 9), heave the nuts round as tightly as they will go, having first placed a little washer of iron between them and the wood of the keel; then drive a wooden plug, coated with white lead ground in coach varnish, over all; this would be a splendid fastening, and no galvanic action can possibly take place. Sometimes the copper sheathing is not continued the entire way down the keel, and then also a false keel may cover the

heads of the fastenings; but under any circumstances the screw bolt fastenings make the best and most secure job.

I am thus particular in drawing attention to the scarphing of, and the fastenings along the keel, as I have seen instances where neglect under this head whilst building has led to great inconvenience afterwards; one, indeed, where the keel not being properly scarphed, the vessel, I may say, had to be built over again; and other instances of slovenly bolting has been the cause of interminable leaks; and a leak along the keel, I need scarcely tell the most inexperienced yachtsman, is one which, to remedy, involves the docking of a vessel, and the removal of her ballast. Of the galvanic action which takes place between copper and iron, I have also seen some remarkable instances; one was where the copper sheathing had been turned in under the keel (there was no false keel), and the iron bolts which fastened the keelson, floor timbers, and keel together, upon being examined in dock, absolutely crumbled away from the touch of a penknife. Another was in the case of a yacht with a metal keel, where the bolts likewise rotted away, and were by chance discovered a day or two before the iron keel must have inevitably dropped off.

In all cases some ballast should be applied externally, in the shape of a metal keel, for the purpose of attaining extra stiffness under canvas; and though there may be differences of opinion to what extent this may be carried, we may mention that the Kilmeny has a lead keel of three tons, which for a thirty-ton vessel, sounds a great deal; but as she has gone through many a hard battle in many a heavy sea, without damage, we may conclude that this proportion for smaller craft is not excessive. The best style of metal keel is lead and iron, the former nearest the vessel, the latter outside, in the proportion of about 2¼ to 3¾, the lesser weight of iron, which will protect the lead from being chipped or bent, should the vessel take the ground; this sort of keel, bolted as aforesaid, should be very efficient; it may be carried from the stern-post to six or seven feet beyond the mast. For a twenty-five ton vessel I would certainly put 2½ tons of metal keel.

I cannot leave the subject of the keel fastenings and keelson without mentioning that some builders do not consider it requisite to put any keelson at all in their vessels, stating, as their reason for not doing so, that it is only vessels which are built with a very flat floor that require a keelson; for that vessels which are built as yachts are, very sharp, and with great rise of floor; from their having the planks of the garboard

strakes, which are of strong elm, nearly on an edge, that they therefore do not require the additional strength of a keelson, the lower external planking being so strongly disposed. This may be all very well, but I think every yachtsman who wishes to have a sound honestly built vessel under him, will see that a properly fitted keelson shall be bolted right fore and aft from deadwood to deadwood; sometimes a metal keelson of short length is introduced, in which the mast is stepped; this makes a very good job indeed, and enables you to get so much ballast well down in a vessel; but even in this case I would have the metal portion of the keelson cast with long plain scarphs at each end, according to the annexed sketch (see Fig. 10), so that the four bolts, A, A, A, A, would take the scarphs and four floor timbers.

I am aware that it is also the practice of some builders not even to revit the fastenings which go through the floor timbers and the keel, but merely to drive them in, neither more nor less than just pinning the floor timbers in their berths; this mode of fastening, together with the absence of a keelson, produces a very weak vessel indeed; one which will strain and work, and a few seasons' hard sailing will go far to alter her form. I am induced to think that this is very often the cause of vessels being found to carry a weather helm on one tack, and a lee helm on the other; or, in other words, what many of us have heard remarked by knowing hands, "Ah, your honour, she has two sides!" Meaning, thereby, that one side was quite different from the other, caused by straining, and the absence of proper and secure fastenings in the frame.

I will adduce two instances that have come under my own notice, in order to show the necessity that exists for proper attention to the fastenings and completion of the frame of a yacht; there is no doubt that, as long as one of these weak yachts is kept afloat, beyond the straining I have mentioned, as resulting from hard carrying on, she may last well enough; but let her once touch the ground through any of the chances or accidents we are all liable to, and she will assuredly come to grief, Some years ago the occurence of a heavy gale of wind at a yachting port where I was residing gave me an opportunity of judging the merits of strong and weak framed vessels; there were a numerous fleet of clippers at anchor, battling bravely with the waves and the wind; suddenly two were observed to be adrift, and as both were new vessels, and gave promise of a superior speed and excellence, no exertions were spared to save them, but in vain. A breakwater of rugged granite rock brought them up—one of them went

to pieces like magic; it was quick, presto, and begone with her; the other vessel stood the bumping in the most wonderful manner; she resounded like a strong cask: the next morning, when the gale had subsided, the whole side of the one vessel, with futtocks, top timbers, and planking, came ashore! a flooring timber here and there remained with the fastenings just drawn out of the keel, showing that she had burst asunder along the keel first: now the other vessel was very strongly framed and fastened, and by her endurance enabled her crew to get her off; and when she was hauled up on the beach, although her planking was all torn to pieces by the grinding against the rocks, and sundry holes knocked in between the timbers, yet her frame was comparatively uninjured, and she is afloat and cruising to the present day.

The yachtsman cannot be too particular in looking after the timber put in the framework of his vessel; any appearance of sap should be jealously watched, and the infected timber condemned instanter. Sap is the cradle of dry rot, and dry rot seals a vessel's doom; possessed of this plague she resembles the human subject in decline, fair and pleasant to the eye, but all that is sound and healthy fleeting fastly and silently away. There is no greater evil to be guarded against in a new yacht than dry rot; to so many causes has its origin been ascribed, both simple and compound, that it would not at all harmonize with my intention in this work, viz. that of being plain and matter of fact, to enter into any lengthened dissertation upon it, furthermore than to state my impressions generally, and the means I conceive most likely to prove successful in avoiding its contaminations.

I believe dry rot to originate from three distinct causes, viz.—FIRST.—The use of green, unseasoned, sappy timber, or partly seasoned timber, in which sap remains, or timber cut at an improper season of the year when the sap is rising. SECOND.—Bad spots, such as weather shakes, curls of the grain, which open and form nests for damp, rotten knots overlooked, short pieces let in as chocks to make up deficiences of length in first or second futtocks, and the frame being set up hurriedly during wet and moist weather. THIRD, and most important of all, the want of proper ventilation between the external planking and the internal planking, consisting of the ceiling, sheetings, &c.

The means I consider most effectual towards the prevention of dry rot, or any species of decay, is that of creating a perfect system of ventilation, by the admission of pure fresh air, and its free circulation through the

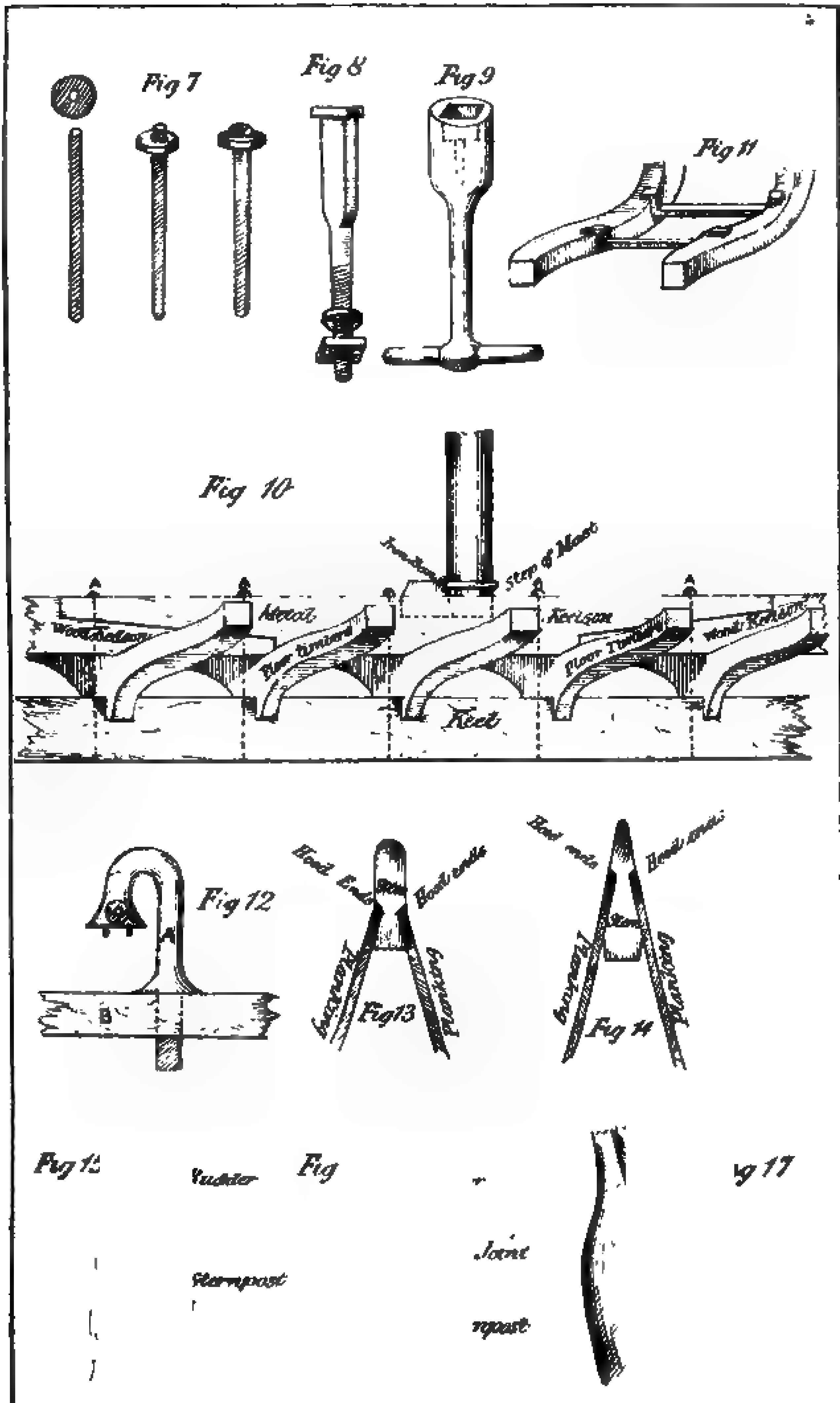


Fig 7
Fig 8
Fig 9
Fig 11
Fig 10
Step of Mast
Metal
Keelson
Wood Keelson
Floor Timbers
Floor Timbers
Wood Keelson
Keel
Fig 12
B
Head Ends
Head ends
Planking
Planking
Fig13
Head ends
Head ends
Planking
Planking
Fig 14
Joint

timbers and plankings composing the frame of a vessel; to effect this perfectly requires a little extra attention; and with which it can be accomplished. There may be many ways of doing it, but I would try the following:—FIRST.—No portion of the ballast should be allowed to rest upon the skin (or outside planking) of a yacht; care should be taken that a full inch or two of clear space exists between the ballast and the skin: the cast ballast that fits between the flooring timbers should be cast with shoulders so as to rest upon the timbers, and the depth of each block should be less by the inch or two required for the air space. The pig metal should be kept from resting on the skin by flat bars of iron bent to fit between the timbers and spiked thereon; they should be shaped as in Fig. 11.

This is not only necessary for the purpose of ventilation, but for the prevention of galvanic action between the copper sheathing of the yacht and the iron ballast, which, should any weak spot in the caulking of the planks exist, admitting of the smallest leak or weep of salt water, would most likely ensue.

SECOND.—Particular attention should be paid to the limbers or water-courses alongside the keelson, leading to the pump-well; this is very often a subject of secondary consideration, but if you want to have your vessel sweet and clean, the trouble is amply repaid; sometimes a rope running along the limbers is used, which, by hauling forward or aft, clears away any obstruction to the waters passing to the pump-well. I would prefer a small galvanized chain, by which little bays of foul-smelling bilge water will be prevented.

THIRD.—I would copy a little from the modern improvements in the big ships of our day, viz., I would have bent tubes let into the covering board on deck; in the wake of the bulwark stanchions, at intervals of every second stanchion or so, and shaped as per Fig. 12.

A—A bent brass tube, cast with a bell mouth.

B—The covering board of the deck.

A little metal ball, resting on two small bars *d d* across the mouth of the tube, which when the vessel is laid over, in blowing weather, and takes water on her deck, is forced by the water up into the position of the dotted line, and effectually closes the tube, rendering it water tight: when the vessel rights again, and the water runs off the deck, the ball falls, and the admission of air continues.

These tubes need not descend much below the covering board. I would complete the arrangement if similar tubes of a larger size were let down one in the wake of the mast, or alongside the bowsprit bitts, and

another alongside the main companion, and both descending to meet the air space at the bottom, this would go far to secure the circulation of fresh, and the expulsion of foul air. With such an arrangement for ventilation I would have very little fear of dry or any other rot.

I am convinced that a thorough system of internal ventilation of the frame-work and planking of a yacht tends to keep her sweet, sound, and buoyant; and will tend, together with other details I shall advert to just now, to prevent her becoming water soaked; it is the moist warm atmosphere which is generated in the spaces between the timbers and external planking and ceiling of a badly ventilated vessel, that causes the evil arising from foul smells, fungous matter, the parent of dry rot, and coupled with external influences, in course of years renders a vessel dull, heavy and water soaked.

Objectionable spots of small size, in otherwise eligible timbers, may be carefully cut out, and diamond pieces inserted with white lead; weather shakes, splits, and through knots in the planking, cannot be too carefully guarded against, as once a vessel is coppered all these sources of leakage are hidden, and almost incurable.

The yachtsman cannot be particular enough in looking after the piece of oak selected for the stem piece; the forestay, the gammon iron of the bowsprit which is bolted on the side of the stem, and the bobstay pennant, individually and collectively, exercise powerful leverage upon it; it should be an even grained tough bit of oak, free from curls or knots.

I once had an opportunity of witnessing the effects of a want of decision and judgment under this head; there was a splendid cutter built by a friend of mine, who spared neither expense nor trouble in making her perfect; the stem was a beautiful looking piece of oak as ever man laid eye upon, but just between the bobstay shackle and the gammon iron there was a great curl in the grain of the timber; this was pointed out to the builder, but he laughed at and ridiculed the notion of such a piece of timber giving up; my friend was tenacious about the matter, but "Chips" would have it "That he'd just give the stem a trial, it was such a beautiful kind working bit of timber, and it would be so hard to get another like it!" So the stem remained, and certainly it was a trial with a vengeance; before she was a week at sea she burst it across just in the heart of the curl, and we lost the best weeks of the season in the dry dock getting a new stem in.

There are many little details connected with the building of a yacht,

which upon a cursory examination, appears so trivial as not to merit that attention which their real importance demands; it is that minute attention to these apparently minor details which ultimately leads to triumphant results when we come to test a vessel's powers to the utmost in match sailing; in the generality vessels the stem piece is sided, or to speak as simply as can be, cut of nearly the same thickness at the back as it is at the front. I shall illustrate my meaning by a sketch, Fig. 13. Hereby it will be perceived that the stem is of nearly the same thickness throughout, and that about two-thirds of it projects beyond the hood-ends, or termination of the planking at the rabbet of the stem; this projection of the stem is of no practical utility whatsoever, and with the present build of fine bowed vessels si rather detrimental to the strength required; by siding the stem wider at the after than the fine side, and moulding it a little deeper, you obtain a light, neat looking stem, much stronger in reality, and instead of being two-thirds outside the vessel, it is two-thirds in her, besides enabling you to prolong the water-lines to the extremities of the vessel, and thus dividing the water as easily and gradually as possible (see Fig. 14): I think a comparison of the two stems will at once show the difference; of course the head of the stem of Fig. 14, will be sided equally at the head for the purpose of receiving the fore-stay, gammon-iron, &c.

The fitting of the rudder to the stern-post is another matter deserving of consideration; some builders still adhere to the old fashioned plan of fitting rudders (see Fig. 15). Here the back of the stern-post is left square, and the face of the rudder-post is bevelled off on each side from the centre, so that its junction with the stern-post forms the apex of a triangle. Now the water in passing along such a vessel's run, curls into the triangular hollows left by the bevelling of the rudder-post before it reaches the rudder, and the yachtsman, if he looks down the rudder casing when a vessel is under weigh that is fitted after this fashion, will perceive a little whirling column of water up and down the stern-post. Now this, let it be ever so little, forms a drag; and a drag of any description, however small, diminishes speed; this, combined with sundry other minor matters that I shall allude to presently, all unite to form a pretty considerable drag; and as prevention is always held to be better than cure, the building slip is the place to avoid such defects: by far the better plan of fitting a rudder is that called the "rule-joint" (see Figs. 16, 17, and 18).

Fig. 16 shows the stern-post hollowed out accurately to receive the convex face of the rudder post; fig. 17 shows the strong brass or copper band, which passing through a mortise cut at the back of the rudder-post, is screwed on the sides of the stern-post, and Fig. 18 shows the rudder held securely in its place by three of these bands; a brass pivot and socket may be seen at A, Fig. 18, the pivot being in the centre of the rudder-post heel, and the socket let into the projection of the main keel. This makes a strong, close fitting job of the rudder, and the water passes along the joint as smoothly as possible: the rudder-post and mortises should be neatly coppered, and the rudder bands should be let in flush, or level, with the stern-post.

A cutter's stem below the load water line should be brought to a feather edge, either by fining away the stem and covering it with extra strong copper, beaten into the shape of a V; or else by screwing on the face of it a piece of brass, cast in a triangular shape, the base of which is placed against the face of the stem, and screwed on from each side alternately;—as much of the keel too as presents its sole angularly to the water should be bearded off, so that the vessel may divide the water forward with the easiest possible effort and not present any useless surface.

The bobstay shackle must not be overlooked, as upon the neatness with which the bobstay pennant is connected with the stem, much of the chance of catching up weeds floating on the surface, &c., is avoided; the neatest and strongest shackle I have ever seen, was made of brass, cast to the shape of the vessel's stem, let in flush with the copper, and riveted right through: it was cast in the shape as shown in Fig. 19. The bolt and score are made of a size to take either a galvanized chain, iron or copper rod, wire, or hemp pennant, so that of whatever material it may be composed it just fills the score, all the angles being rounded off and the bolt countersunk, nothing in the shape of weeds or sea-grass can effect a lodgment on the shackle.

I may adduce as an instance of the utilty of a neatly-fitted bobstay shackle, that some years ago being engaged in a race, in which we were leading well, suddenly vessels that we knew we were well able to beat, ran past and ahead of us considerably: not a sheet, or halliard, or inch of canvas, that was not scrutinized narrowly; then down we went below to see if any one had been playing tricks; all was of no avail; one of the crew happening to look over the bow, the murder was out—there stuck

to the bolt of the bobstay shackle, and increasing as we went, was a huge mass of weeds and sea-grass, which no doubt afforded our antagonists a hearty laugh as they slid slyly past; however, to work we went with the boat-hooks, cleared our fore-foot and speedily set the laugh the wrong way; the wind being light and little way on us, there was no extra ripple to attract attention, and but for the chance look out of our acute seaman, the probability is that, like a resolute widow, we should have carried our "weeds" to the end of our career, although probably not with the same virtuous intention.

The solid channels as introduced by the "America" are an improvement worthy of being copied, as doing away with a certain amount of resistance to a vessel's passage through the water, and also constituting a more solid and effectual resistance, to the great strain brought to bear upon them by the chain plates of the main rigging; the old style of channels and chain plates are liable to catch any floating weeds, sea-grass, or other substance calculated to obstruct the water: a reference to Figs. 20, 21, 22, and 23, will, I think, prove this.

Fig. 20 represents the usual method of putting on the channel and chain plates, of which Fig. 21 gives a transverse section, showing pretty clearly the great amount of drag there arises on the side of a vessel, besides the possibility of picking up floating weeds, grass, &c. Fig. 22 represents the more ship-shape solid channel, with short chain plates, bent to the shape of the channel, and (Fig. 23) let in the level with it: Fig. 23 will show this, as also the diminution of drag, at least until the dead-eyes are immersed, when of course the upper and remaining half of the drag comes into operation in the shape of the dead-eyes, shrouds, lanyards, &c.

Now that we are beginning to find out that these long lean ribbed racers are not the thing for sea work, and that a fair allowance of beam is again becoming the fashion, I may venture to hint upon the only secure and safe plan of doing away with the channels and projecting chain plates; the only utility of channels is that of obtaining in a yacht of narrow beam the requisite spread for the shrouds in order to support the mast. I have seen yachts fitted with channels, and with long chain plates, to which the dead-eyes hooked on, on a level with the rail: this is a bad plan, inasmuch as you must have extra strong, or double bulwark stanchions, which makes the deck work look heavy; otherwise the strain of the rigging on these long chain plates must soon destroy the appearance of your vessel's bulwarks and rail; but the most complete and solid method of fitting chain

plates, where you have sufficient beam for spread of rigging is, by letting them in flush with the vessel's sides, turning the heads in over the covering board and under the wash strake, and bolting the dead-eyes on to them inside the bulwarks. Some may object to this method, and say that a vessel fitted in such a manner looks as if she was turned out steam-boat fashion. My dear good yachtsman never mind what anybody says, so long as you feel honestly assured that you can effect an improvement or achieve a success; and surely every obstacle to a vessel's speed that can be removed is an improvement, and tends to ensure success.

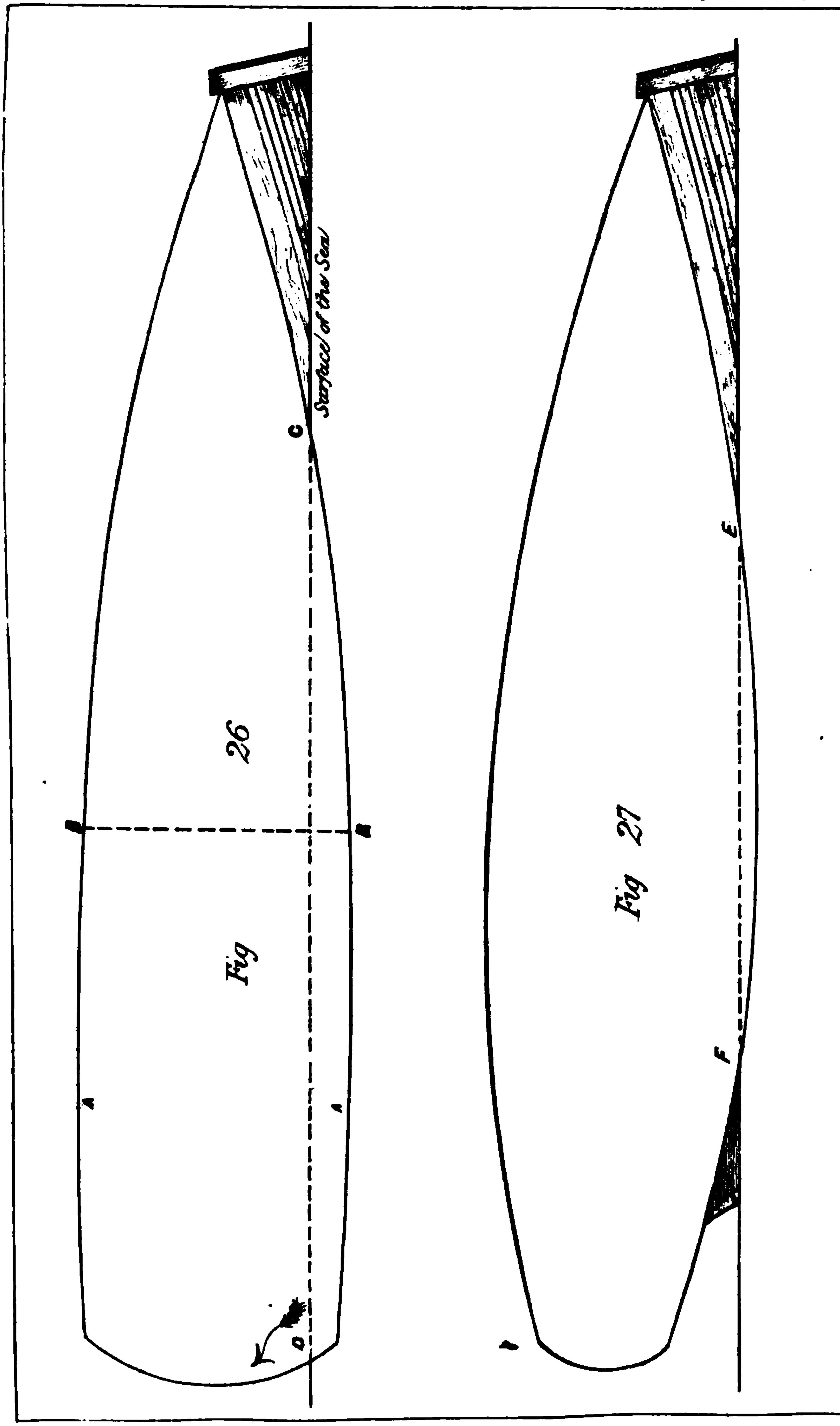
Let any one take a boat-hook staff, and when a vessel is close-hauled under a press of canvas, shove about a foot or so of the staff into the sea on the lee side and endeavour to hold it in that position; my word for it we should soon find that the holding of even this small spar shook us not a little, proving the immense power exercised by water on any body, however small in its passage opposed to it at right angles; therefore what a fearful drawback must be the ordinary plank channels, with their angular chain plates, lower dead-eyes, shroud lanyards, topmast shroud blocks, tackles, &c. On the outside of a vessel intended for speed there should not be allowed any fittings or their fastenings, even to the head of a half-inch bolt, to project at right angles to her planking; some few there are, such as pertains to the bowsprit shrouds, that cannot be avoided; but even these we hope to see put an end to. Only let us once ignore that bugbear reason adduced upon all occasions when common sense is pitted against prejudice—"Sure it's the custom!"

Plate 4.

*Fig. 24.*

*Fig 25.*

Plate 5.



## CHAPTER IV.

" And first, with nicest skill and art,
Perfect and finish in every part,
A little model the Master wrought,
Which should be to the larger plan
What the child is to the man,
Its counterpart in miniature;
That with a hand more swift and sure
The greater labour might be brought
To answer to his inward thought."—LONGFELLOW.

I NOW come to a very important part of a yacht's hull, and that is the counter; upon the manner of finishing which depends not only her personal appearance, but the possession of properties closely allied to speed and sea-worthiness: it has been the custom to finish off the after body of a vessel with what was called in yachting *parlance* "a square tuck," from which sprung the counter. This, both in theory and practice, was bad, essentially bad; it was bad in theory because contrary to the laws of least resistance to the passage of the globular particles of which water is composed; and in practice, contrary to the laws governing the construction of bodies liable to violent action, exercised in the shape of powerful vertical and horizontal pressure, acted upon proportionately by atmospherical agency.

Now although the shape of the stern of a vessel may not appear to affect her speed so much as the shape of her stem, yet unless both harmonize, very serious results may be produced; this must be evident to any yachtsman who has the slightest knowledge of naval architecture.

Upon reference to Fig. 24, we will suppose the water to be rushing past the vessel's quarter in the direction of the arrows A A, when it arrives at the position of the arrows B B it rushes up vertically to fill the vacuum caused by the square tuck C, and thus a pretty considerable frothing and curling mass of water is formed under the counter, into which a vessel squats as it were, and thus a terrible drag is formed;

not only this but when such a vessel is running in a heavy sea, the following wave strikes the flat counter and square tuck, with great violence, shaking the vessel considerably, and causing her to steer wild. Upon inspection of Fig. 25 where the planking of the vessel is continued up to the covering board, it forms much the neatest, and by far the strongest stern, it is much more troublesome to construct, but its advantages amply counterbalance the additional trouble; here no drag can exist, and if the vessel's after lines are properly proportioned, the water is delivered along her run and under her counter easily and regularly without wave or curl, and closing around her after body with moderate and equal force in order to resume its equilibrium after passing her midship section, it tends to assist her rapid progress by the very laws which govern its motions.

A vessel's quarters should not on any account be flared out, this is sometimes done to obtain additional room on deck, but it is a great mistake, what you gain in room you lose in speed, for a great flaring quarter when immersed in the water (the vessel being close-hauled) presents as great an obstacle to speed as any I have enumerated, besides which you cannot with a flaring quarter retain that fair round side which is so essential to send a fast cutter up to windward. I shall endeavour to explain my meaning by two sketches, Figs. 26 and 27.

In Fig. 26 we have one of those long narrow "all legs and wings" racers, with her quarters, A A, flared out, or if it prove more explicit, her main breadth of beam at B B carried all the way aft on deck, thus causing her quarters to flare out. When she is close-hauled and laid well over in a fresh breeze, her lee rail and deck will be immersed from C to D: in fact her deck will be full of water, which will surge along to her counter timbers, and curl up over her taffrail in the direction of the arrow,—this I have seen to occur in such vessels; and I need hardly call the attention of the yachtsman to this glaring defect of construction.

In Fig. 27 we have a good beamy wholesome vessel, "round as an apple," as the saying is, and yet fine withal below, she is drawn fine gradually aft, and her quarters neatly rounded up. Such a vessel will be hard to lay over, will have no dragging quarters when heeled over, and even when laid over she will only take water from E to F; when if her wash strake be properly fitted with roomy scupper lids, her deck will soon free itself of the water.

*Plate 6.*

Fig 29.

Nothing adds so much to the appearance of a vessel's hull, as the manner in which her decks are laid; the deck planks should be cut narrow, say not more than three or three and a half inches, and should be tapered away fore and aft, so that the seamings of the deck may sweep as nearly as possible with the curve of the planksheer, or covering board.

Heretofore it has been the fashion to run the deck planking home midway on the counter timbers over the deck transom, allowing the timbers to show. The top transom, to which the lower main sheet block, or the horse, is bolted, being about a foot, more or less according to the size of the yacht, above the deck, and the counter timbers are then sheeted over fore and aft, from the inner edge of the top transom for two or three feet, either by neat oak or mahogany grating or light deck planks, and thwartships it is framed into little lockers with grated doors, which form receptacles for anything and every thing; spare blocks, paint pots, vegetables, meat, &c.; not forgetting any amount of not come-at-able dirt. Now, although these little grated or planked poop decks form convenient seats as well as lockers, and may appear uncommonly ornamental as well as useful, yet I am by no means clear that they are not injurious, as from the quantity of odds and ends that are stowed away, and gradually increase, of course nobody knows how, superfluous weight is thoughtlessly accumulated in a part of the vessel which of all others should be kept free of it. The lockers may not be so rigidly cleansed and kept dry as necessity requires, and consequently damp and rot becomes engendered in the counter and quarter timbers. A very light grating, just large enough for the main sheet to be coiled upon, is quite sufficient, as it can be made in framed parts, easy of removal when the decks are being scrubbed.

In Fig. 28, I have endeavoured by a rough sketch to delineate the usual method of finishing our cutters' after decks, the dotted lines representing the part of the little poop deck, with its inviting show of lockers;—from A to B it is sheeted over as before described.

In Fig. 29, I would call to the notice of yachtsmen a method of finishing the after deck which has of late been introduced, which is a decided and valuable improvement. By this method the counter timbers do not show, the deck plank springs for the last six or eight feet into a neat quick sheer, and finishes up close under the top transom; it makes a very pretty finish; the upper part of the deck is always

dry; there are no lockers for the accumulation of useless lumber, dirt, and damp, but a neatly finished oak or mahogany grating for the main-sheet to be coiled away upon, completes its light and elegant appearance.

There are many who strongly advocate the coppering of a new vessel before she is launched, others there are who prefer working a vessel for a season or so, previously to coppering; I confess my own predilections would be in favour of the latter course. If you want the yacht for racing, of course the idea naturally suggest itself, that it would be necessary she should be coppered at once, in order to ensure the requisite smooth bottom.

Let us consider whether it would not be more advisable to work her during the first year, aye even to race her, without coppering: In the first place the frame and planking will have settled into their berths, and any deficiency of caulking in her planks caused by the working of the new timber, or by carelessness in the outset, can be easily remedied, which, were she coppered could not be done, but at great expense, for the copper would have to be stripped off: the second year her plank and frame will be seasoned, get her into a dry dock, examine carefully for all leaks or weeps which will show themselves if she be not pumped dry before docking her; overhaul all her caulking, and then copper, you will have a vessel smoothly sheathed, and as dry as a bottle.

It is a popular notion with some good folk that unless a vessel is coppered she is not properly built, must be leaky, and cannot be properly recognised as a yacht. Now there is no doubt that a copper bottomed vessel presents a very neat and finished appearance, and has an aristocratic thorough-bred look; but let us properly understand beyond the mere matter of appearance, the practical utility of copper as a sheathing material: it presents a uniform smooth surface, prevents the rapid formation and growth of marine grass, weeds, and slimy vegetation. The chemical action which takes place on its surface from exposure to air and water produces the oxyde, green rust, or verdigris, which is destructive to animal life, and greatly prevents the incrustations of marine animals, such as *Serpulæ,*—these little animals which form such queerly contorted white tubes; the adhesion of the Clustering barnacles (*Lepas Anatifera*), of the Arcon barnacle (*Balanus Ovularis*), and the attacks of the *Teredo Navalis*, the ravages of which are fortunately but of rare record in our seas. Copper sheathing requires to be

scrubbed and cleansed periodically, as notwithstanding every precaution there is a green deposit, a sort of slimy vegetation, giving forth a soft woolly crop, which forms upon it; besides which if it is not thus occasionally kept clean and bright, from the constant oxydation the surface of copper becomes unequal and rough, and if the vessel remains at moorings for any length of time the incrustations of marine animals, and the deposit of green slimy weed and grass immediately takes place. A vessel constantly underway is less liable to these evils, but sometimes when copper becomes much worn and thin, painting is resorted to, the result of which is that the bottom becomes foul in a very short space of time, particularly from the operations of these terrible little animals the *Serpulæ*.

Some yachtsmen are of opinion that by copper sheathing alone can be obtained a perfectly smooth bottom; this is by no means the case, the very heads of the nails which fasten the sheets, and the edges of the copper sheets themselves, constitute inequalities of a serious magnitude.

In order to obtain the smoothest possible surface to a yacht's bottom, the following course might be tried; where great speed was required, and particularly for racing, it might be found of great advantage, and I have little doubt would immensely augment her speed; when the yacht was finished and her seams ready for caulking, I would have an awning of old sails, tarpaulins, or any covering suitable for the purpose erected over her; I would then set half a dozen cabinet-makers at work to plane, scrape, and glass paper her bottom, until it was as fine and as smooth as the top of a mahogany dinner table. Set the caulkers at her next, cautioning them to harden in the oakum a little more than usual, so as to make the seam a thought deeper to receive the paying: this operation being completed I would turn to with the cabinet-makers' men again, and bring all smooth after the caulkers; and then for the most important part of the work; in the first place not a bit of pitch or tar should go into her seams or on her bottom, but engaging coach painters to do the work, men who can bring the smooth wood up to a surface like unto that of plate glass, I would have two or three coats of priming paint laid on, then the seams; but every inaccuracy of surfaee which plane or glass paper had failed to remove, I would have well payed with a putty of white lead ground with coach varnish; after this I would have her well water pumiced, and a couple more coats of priming

laid on and pumiced in, after which the coach painters will know how to complete their task. I think white lead ground in coach varnish will be found the best paint for finishing coats; it may be coloured with ochre or sienna, so as closely to resemble copper: and if a coat of copper bronze ground in the best copal varnish be laid on over all the illusion will be complete. This is the best method of securing a perfectly smooth surface to a yacht's bottom: it is no doubt very troublesome, and yachtsmen and builders will doubtless pooh, pooh, at such trouble; but good reader, if we all walked in the footsteps of our forefathers the world would be at a stand still, and nothing new would ever be attempted; it is only by stepping boldly out of the old routine system that we can ever expect to attain perfection; if you enter the yacht racing world be prepared to do anything and everything that may promise legitimate success; details that are troublesome, and may apparently seem useless and contemptible, if energetically and properly attended to, very often result in triumph, and if you will take the hint and act accordingly, with prudence and judgment, you will awake some fine morning and find yourself famous.

There is a matter connected with copper sheathing which has often occupied my attention; when a new vessel is to be coppered on the stocks, after her seams are payed, a coating of pitch and tar is laid on, then a layer of brown paper, and lastly the copper sheets are nailed over all. Now no matter how carefully or well she may be done, the edges of each sheet and every nail that is driven, is conducive to capillary attraction, and the water wells in between the vessel's planking and her copper; any badly caulked spots in her seams are sure to leak, and the planking being pierced by thousands of small nails becomes gradually water soaked; the vessel in course of years becomes sluggish; is not half so light and buoyant as when first launched, and although her form is in every apparent respect the same, yet she becomes a dull sailer, sits deeper in the water, and although her speed may have hitherto been undeniable, all of a sudden she is beaten and cannot sail as she used to do; some attribute this to a change of hands or management, others say that her day has gone by (perhaps she may not be five years old), there is no doubt that great improvements have been made, and are still making in the architecture of yachts, but I think we shall have to overhaul our present system of coppering as to the manner in which it is put on, and likewise the internal ventilation.

Copper sheets are four feet in length by fourteen inches in breadth, and each superficial foot is supposed to contain as many ounces as its class denominates, thus we have 16, 18, 20, 28, 32 ounces, and so on; that copper which contains the most ounces per foot being of course the thickest and heaviest; these sheets are fastened on with flat headed composition nails made for the purpose.

For a 50-ton cutter 18oz. copper for lower and after sheathing, and 20oz. for the bows, from the water line up, and as far aft as the runner tackle. For a 25-ton cutter 16oz. copper for the lower and 18oz. for the upper sheathing will be found a good size. I have weighed sheets of 18oz. copper, and found them on an average from 5lb. to 5lb. 8oz. each, and that from 22 to 25 sheets went to a hundred weight. I mention heavier copper for the bows, and from the water line up, as far aft as the runner tackles, for the reason that on the bows, and between wind and water, copper suffers most wear and tear; aft and under the counter, it is not near so much scrubbed by the crew as it is forward and along the side; and nothing wears copper faster than too much scrubbing.

I have heard of a coating for vessels' bottoms, which has been stated to me as producing an extremely smooth and lasting surface; the bottom having been carefully planed over, and the seams payed, the whole is well-coated with pitch and tar mixed, when this has become pretty firm, it is gone over neatly with a thin coat of coal tar, which, when "nearly" hard, is coated with a mixture, composed of powdered black lead, ground up with spirit of wine; the spirit of wine evaporating, precipitates the black lead on the coal tar, when the entire surface should be gone over with hard brushes, and polished until it is as bright and smooth as burnished steel.

Powdered black lead mixed with sour porter to the consistency of oil paint, likewise makes an excellent coating, smooth and durable; but all such coatings upon the bottom of a vessel, require frequent renewal, and very much more looking after than if she were coppered, and it is not in every harbour that you can lay a vessel high and dry on a beach to examine and coat her bottom, and docking her is not only very troublesome, but extremely expensive. There is one great objection to the use of black lead; very often, as any practical yachtsman must know, sails will get over the side, and should they catch up any stain of the black

lead, farewell to your sail; it is nearly as bad as mildew, and as hard to eradicate.

We should turn our attention most earnestly to the finishing and coating of yachts' bottoms; it is a most important and essential item that has been too long overlooked; in any business or pleasure that a man may be embarked in, the perfection of details ensures the success of the one, or the perfect enjoyment of the other; therefore, to bring yacht building and yacht sailing to perfection, we must first reduce them to a matter of strict business, whereby the details may be duly and properly matured; this once accomplished, the enjoyment thereof is within our grasp.

## CHAPTER V.

Behold her rigging, so wire-proof strong,
  See how taut it stands and bears the strain
Of the bending mast, as she careers along
  With mad'ning force thro' the raging main.
    "Hold on, good ropes," the steersman cries,
    "And the saucy Julia wins the prize."

THERE is not any portion of a yacht's fitting-out that requires more care and supervision than the "rigging," not only as to the materials of which it is composed, but as to the manner in which it is fitted. There are various opinions entertained as to the relative merits of "hemp" and "galvanized wire" standing rigging. Whilst we pay great attention to the form of the vessel's hull, the placing of her ballast, and the proportions of her spars and sails, I much fear we do not attach sufficient importance to the rigging. I may be wrong, but I have always been impressed with the idea that in obtaining the best sailing trim of a yacht, the "tautness" or "slackness" of the "shrouds" "forestay," and "runners" and "tackles" are not sufficiently attended to in the generality of cases. I have seen them watched and tended with anxious nicety, and very beneficial results ensue, and I venture to suggest that trimming by the rigging should form a large item in our practice. From several instances that have come under my observation, I have been under the impression that a weak built vessel, whose hull works and springs, even moderately, is by no means adapted for wire rigging, such a vessel will, I think, be found to perform more satisfactorily under hemp rigging; it will work kinder, give and take with her workings more evenly, whereas the wire rigging will be found rather rigid, and having a tendency to bring her up with a jerk: a strongly framed vessel may be wire rigged with great advantage; bearing this in mind that your shroud lanyards will not give sufficient play and spring to your spars, the wire shrouds themselves must be left somewhat slacker than hemp, as there is little or no stretch in the wire, but a very great deal in the hemp; and a hempen stay which at moorings appears to be set

up very taut, will be found to stretch and spring considerably underway; whilst a wire shroud that has a slack easy spring in it at the moorings, will prove as taut as a bar of iron when underway. We are getting more experience season after season in the management of wire rigging, and some of the fastest craft afloat now are fitted with it; it is lighter in appearance and weight, does not present so much surface to the action of the wind, and if properly attended to, is more lasting; all wire rigging should be well galvanized. Messrs. R. S. Newall & Co., of 130, Strand, London, the Patentees of this rigging, have Agents at the different seaport towns; it is well to bear in mind that the process of galvanizing the wire weakens it in strength about 25 per cent., this I was informed in Mr. Newall's establishment, in London, and the means of my gaining the information was the carrying away of a wire forestay, when it was remarked as to the cause thereof, that the additional 25 per cent. of strength requisite, had not been allowed when calculating the equivalent strength of the wire, to the hemp forestay; it may be useful therefore to remember this, as all tables that I have seen showing the relative strength of the different sizes of "hemp" and "wire" rope, appear to have been calculated from the plain wire, not galvanized; therefore 25 per cent. would have to be added to the sizes of the wire.

I here insert a copy of Messrs. Newall and Co.'s table for the information of yachtsmen.

| Hemp Rope. | | Wire Rope with Equivalent Strength. | | | | |
|---|---|---|---|---|---|---|
| Inches in Circumference. | lbs. Weight Per Fathom. | Inches in Circumference. | lbs. Weight Per Fathom. | Breaking Strain. | Working Load. | Price Per Cwt. |
| 2¾ | 2 | 1 | 1 | 2 Tons | 6 Cwt. | 56s. |
| | | 1⅛ | 1½ | 3 " | 9 " | " |
| 3½ | 4 | 1⅜ | 2 | 4 " | 12 " | " |
| | | 1¾ | 2½ | 5 " | 15 " | " |
| 4½ | 5 | 1⅞ | 3 | 6 " | 18 " | " |
| | | 2 | 3½ | 7 " | 21 " | " |
| 5½ | 7 | 2⅛ | 4 | 8 " | 24 " | " |
| | | 2¼ | 4½ | 9 " | 27 " | " |
| 6 | 9 | 2⅜ | 5 | 10 " | 30 " | " |
| | | 2½ | 5½ | 11 " | 33 " | " |
| 6½ | 10 | 2⅝ | 6 | 12 " | 36 " | " |
| | | 2¾ | 6½ | 13 " | 39 " | " |
| 7 | 12 | 2⅞ | 7 | 14 " | 42 " | " |
| | | 3 | 7½ | 15 " | 45 " | " |
| 7½ | 14 | 3⅛ | 8 | 16 " | 48 " | " |

| Hemp Rope. | | Wire Rope with Equivalent Strength. | | | | |
|---|---|---|---|---|---|---|
| Inches in Circumference. | lbs. Weight Per Fathom. | Inches in Circumference. | lbs. Weight Per Fathom. | Breaking Strain. | Working Load. | Price Per Cwt. |
| | | 3¼ | 8½ | 17 Tons. | 51 Cwt. | 56s. |
| 8 | 16 | 3⅜ | 9 | 18 " | 54 " | " |
| | | 3⅜ | 9½ | 19 " | 57 " | " |
| 8½ | 18 | 3½ | 10 | 20 " | 60 " | " |
| | | 3⅝ | 11 | 22 " | 66 " | " |
| 9½ | 22 | 3¾ | 12 | 24 " | 72 " | " |
| | | 3⅞ | 13 | 26 " | 78 " | " |
| 10 | 26 | 4 | 14 | 28 " | 84 " | " |
| | | 4¼ | 15 | 30 " | 90 " | " |
| 11 | 30 | 4⅜ | 16 | 32 " | 96 " | " |
| | | 4⅝ | 18 | 36 " | 108 " | " |
| | | Galvanized, 66s. per cwt. | | | | |

For sliding lights, louvre ventilators, &c., in state cabins or saloons, Messrs. Newall have some beautiful copper wire line, with brass sheaves to suit, which work admirably with counterbalance weights.

A vulcanized India rubber collar might be applied with much advantage, for the eyes of the wire rigging and collar of the forestay to fit over, it should be cast to fit over the head of the main-mast and to rest upon the hounds; this would partly supply the want of elasticity in the wire rope.

I will here give the proportions of the different ropes used for the rigging of a 50 and a 25-ton cutter respectively.

### A Fifty-ton Cutter.

Main shrouds ........................................................from 5½in. to 6in.
Forestay....................................hemp from 7in. to 8in. wire 3¼in. to 3⅜in.
Bowsprit shrouds.........................hemp from 4in. to 8in. wire 2in.
Bobstay pendant.........................hemp from 5in. wire 2¼in.
(Or if a Galvanized Chain Pendant, it should be ⅜ to ½in. link.)
Topmast shrouds.......................hemp from 3in. to 3½in. wire 1½in. to 1¾in.
Topmast stay ...........................hemp from 3in. to 3½in. wire 1⅜in. to 1¾in.
Main halliards .... ....................hemp 3½in.
Peak halliards .........................hemp 3½in.
Jib halliards ..............................hemp 4in. Galvanized Chain.
Bobstay fall ...............................hemp 3in.
Bowsprit shroud falls ......... .....hemp 2½in.
Topmast shroud falls ...............hemp 2in. to 2½in.
Jib purchase fall .......................hemp 2in. to 2½in.
Peak purchase fall .............. ...hemp 2in. to 2½in.
Main halliards purchase fall ......hemp 2in. to 2½in.

It is not the general practice to fit the main halliards with a purchase, but it is an excellent plan, and no racing cutter should be without it; it should be fitted with two double blocks, similar to a top tackle; (see Figs. 30 and 31), or with fiddle blocks which make a neater finish.

Main sheet of white rope, Manilla or Cotten 4in., cable laid.

The manner in which the main-sheet of a cutter, particularly a racing cutter, is fitted, deserves particular attention; some are fitted to traverse on horses with a single quarter block, and a single fall, others are fitted with a centre leading block, and single fall, but the main-sheet fitted with double falls is by far the best.

In Fig, 32 we have a main-sheet block fitted with a double boom block A, a double lower block B, and a single leading quarter block C, the lower block B, traverses on the iron horse D, which bolts to the transom E. The main-sheet fall F (single fall) reeves through the quarter block C, and belays on the starboard quarter at G. According to the sketch I have given, the vessel is represented as on the starboard tack, carrying her boom on the port quarter. Now, if the main-sheet, fitted in this manner, be trimmed to a nicety in a vessel she will be going all right, so long as she is on the starboard tack, but the moment she goes about and becomes on the larboard or port tack, carrying her boom on the starboard quarter, the trim of the mainsail is destroyed; the main-sheet becomes longer by half the distance of the fall F from C to A, and the boom block instead of forming the same angle with the lower block, as delineated by the dotted lines, is shifted to H, thus increasing the angle formed by the boom with the mast and keel; and destroying the trim of sail under which perhaps she was sailing her best whilst on the starboard tack; a very smart cutter sailor would of course remedy the evil every time she went about, but we are not all as smart as we ought to be at all times; this alternate shortening and lengthening of the main-sheet may be obviated by having the quarter block C bolted to a ring bolt at I in the centre of the transom; but then another disadvantage of this mode of fitting with a single fall is, that when your starboard quarter is the lee quarter—you are close hauled upon a fresh breeze with a heavy sea on, and to get a pull at your main-sheet is of the last importance; to do so your crew must get down upon the vessel's lee quarter, where they are not only hampering her by doing so, but rarely can round in more than a few inches of the sheet; then again, in "wearing" or "jibing" ship, the main-sheet requires to be rounded in

Plate 8.

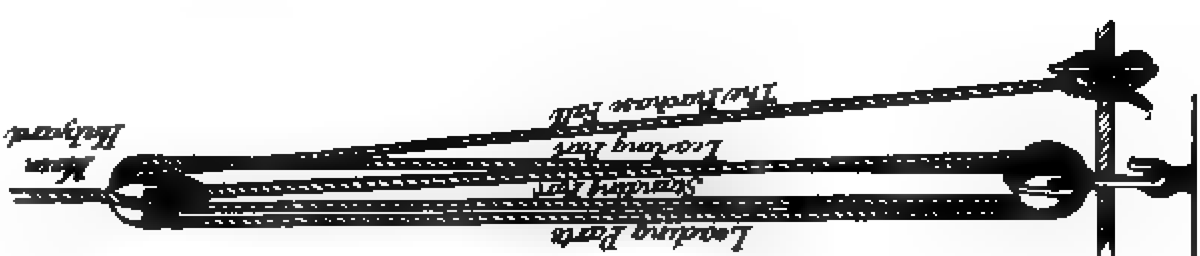



Fig 30
Purchase

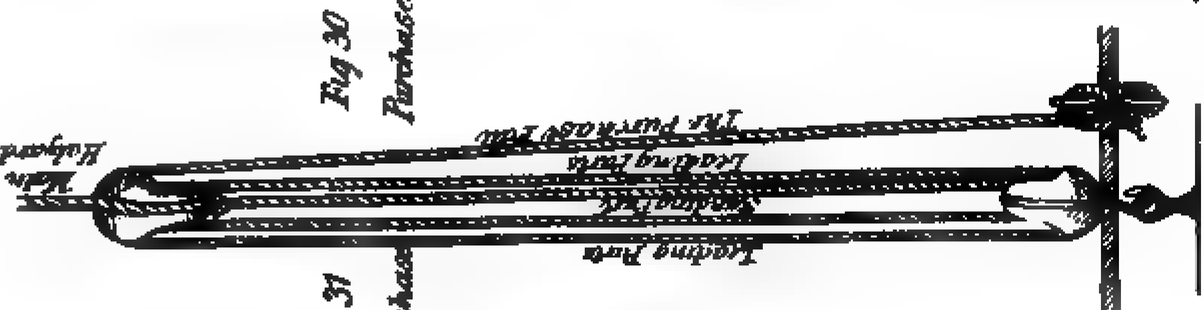



Fig 31
Purchase

Plate. 9.

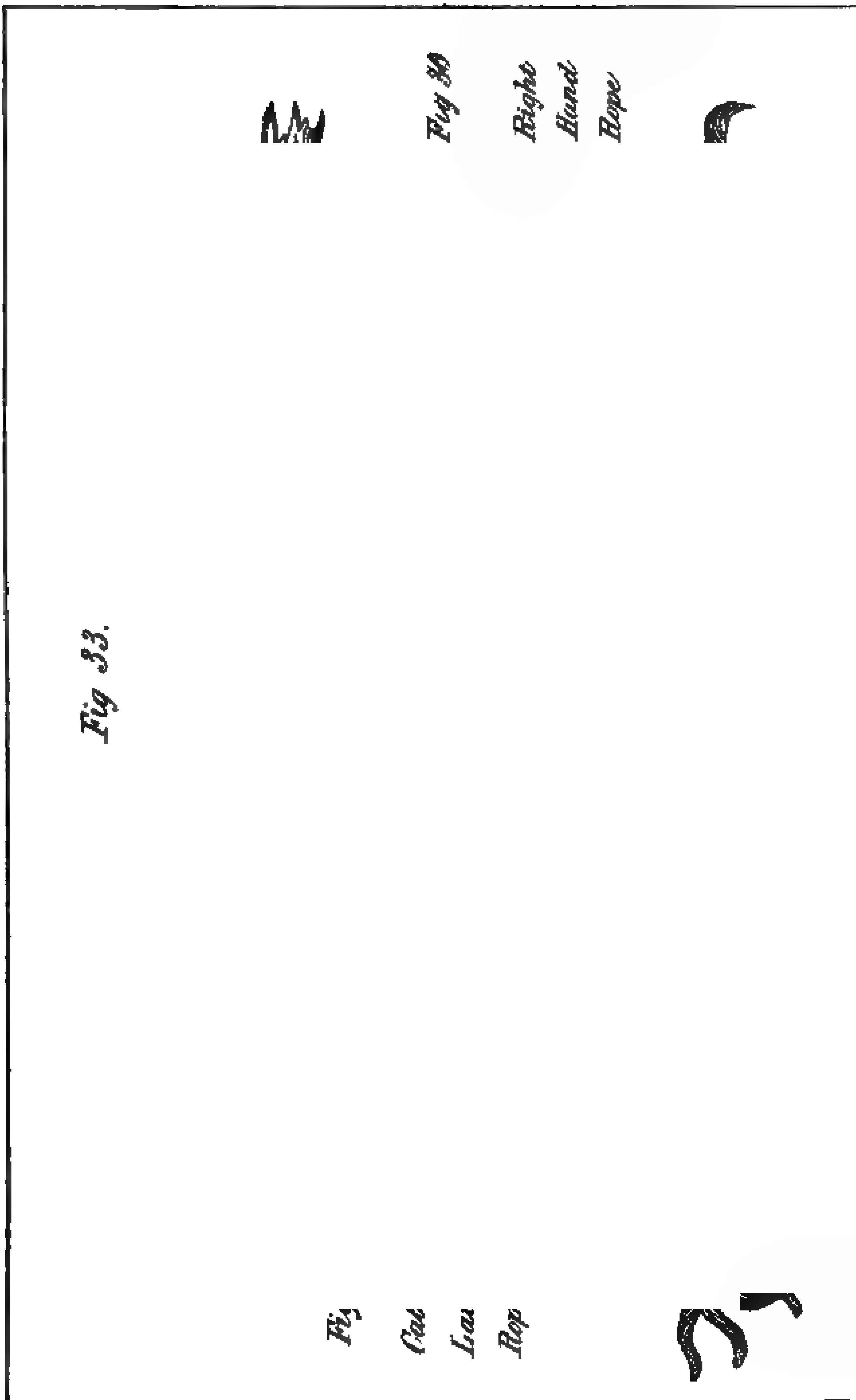


Fig. 35.

Mr Bridsons plan of Boom, or Preventer Guy for avoiding Sudden Shocks.

Fig 34

hand-over-hand like lightning, and paid out again with the like rapidity, in order to perform the manœuvre handsomely, and as it should be done, without endangering the spars or rigging.

The most complete and powerful method of fitting a main-sheet is that which I have endeavoured to illustrate by Fig. 33.

Here we have a treble block at A, a double lower block at B, and two single leading blocks at C and D. The lower block B does not traverse on a horse, but is iron strapped, and fitted with a tumbler which is let into an iron-plated mortice in the transom, and secured with a transverse pin. In a sheet fitted in this way; when once it is trimmed, it will always form the same on either tack (see dotted lines), and if you want to round in a few inches, you always have a weather fall, and as your crew in racing are always crouched along the weather bulwarks, by one hand laying along the fall on the weather side, all hands can tail on to it without stirring from their position, where they act as ballast; then if you want to jibe, you divide your crew on both mainfalls E E, rouse in the boom hand-over-hand as the vessel comes upright, and pay it out as quickly and evenly as the nicety of the manœuvre requires.

Many yachtsmen consider this mode of fitting a main-sheet imperfect unless the lower main block traverses on a horse; there is no doubt a good deal to be said in favour of it, as the block settles down at either end of a horse you have a more direct downward pull on your boom; in this mode of fitting it is a great addition to apply India rubber collars upon the ends of the horse: they greatly tend to relieve the severe jerk on the main-sheet, the blocks, and the entire stern framing of a yacht, when she rolls, in a quarterly sea, or going about with a heavy sea on. They are applied as represented in Fig. 34.

That well-known and talented yachtsman, Rear-Commodore Bridson, has invented a very ingenious preventive guy to be applied to the main-sheet fall upon such occasions. I have tried it myself, and found it to answer admirably; with his permission I insert a sketch of it, made by himself with a description of the method of applying it, and the results thereof.

Boom Guy or Preventer for Avoiding Sudden Shocks.—Fig. 35 represents an apparatus I have adopted for avoiding the severe jerks and shakes that a cutter yacht, with a heavy boom has to encounter, when going free with little or no wind and a heavy rolling swell:—B B are two bars of iron with eyes or hooks; A A are cylinders of vulcanized

India rubber; C is a line that checks the extension of A, A, and prevents them from having too much strain put upon them. The length of the apparatus is about 6 feet, and will stretch 8 or 9 feet. One end is hooked to the main-sheet horse, or main block, and the other made fast to the standing part of the main-sheet; first hauling in the sheet for about a foot or so, when the apparatus is fixed, slacking it again so that the strain comes upon it. The main-sheet is belayed as usual, so that should the apparatus give way, the sheet brings it up.

## Proportions for a Fifty-ton Cutter Continued.

| | |
|---|---|
| Topping lifts, if double | 3in. |
| Topping lift falls | 2½in. |
| If single topping lift is used it should be | 4in. |
| Reef pennant | 3½in. |
| Reef tackle | 2½in. |
| Jib sheets | 4½in. |

Properly made jib sheets will be divided into three parts, the centre part or bunt of the sheet, will be the full size of the rope, 4½ inches, and the parts will be tapered down gradually. Such sheets must be made thus at the rope walk.

| | |
|---|---|
| Fore or staysail sheets, rove double | 2½in. |
| Boom guy pennant | 4in. |
| Boom guy fall | 2½in. |
| Trysail sheets | 3in. |
| Peak downhaul | 1½in. |
| Main tack tricing line | 2in. |
| Gaff topsail clewline | 2in. |
| Gaff topsail halliard tie | 3in. |
| Gaff topsail halliard fall | 2½in. |
| Gaff topsail sheet | 3in. |
| Squaresail yard (cross-jack yard) | |
| jack stay | 3in. |
| halliards, braces, and lifts | 2½in. |

The principal blocks required will be—

Main halliards—one 9in. double block, lower—one 9in. treble block, upper two 4½in. double block, purchase.

Peak halliards—five 8in. single blocks—one 5in. double block, and one 5in. single blocks, peak purchase.

Main-sheet blocks—one 9in. treble block, boom—one 9in. double block, horse, two 4½in. double block, quarter leading blocks.

Jib halliard blocks—one 7in. single block, strapped with iron, forming large hook—two 8in. single blocks—one 5in. double block and one 5in. single block, jib purchase.

Bowsprit shroud blocks—two 6in. double blocks—two 6in. single blocks.
Bobstay blocks—one 7in. single block, iron strapped, with long shank and hook—one 7in. single block.
Topmast stay block—one 4in. single block, iron strapped, with long neck to clear traveller on bowsprit.
Fore halliard blocks—one 5in. single block, top—one 4in. single block, fall.
Fore sheet blocks—four 4½in. single blocks.
Cross-jack yard blocks—one 4in. double block—one 4in. single block.
Gaff-topsail halliards—one 4in. single block.
Throat of gaff—two 4in. single blocks.
Main tack—one 3½in. single.
Fore tack tackle—two 4in. single blocks.
Main tack tackle—two 4½in. single blocks—one 4½in. double block.
Topmast shrouds—eight 4in. single blocks.
Gaff-topsail clewline—one 3½in. single block.
Gaff-topsail tack tackle—two 4½in. single blocks.
Reef tackle—one 5in. double block—one ditto single.
Burton—two 4½in. single blocks.
Runners and tackles—two 6in. pendant clump blocks—two 9in. sister blocks, two 4in. single blocks, rails.
One small brass gin block for gaff end, for ensign halliards and peak downhaul.

GROUND TACKLE:—

One best anchor 3½ cwt., one second or working anchor 3 cwt., one kedge anchor 1 cwt. One chain cable, ½in. link, 90 fathoms; one 4in. hemp hawser.

In getting the rigging over the mast-head observe that the starboard fore shrouds (a pair) goes over FIRST. The port fore shrouds (a pair) goes over SECOND. The starboard after shroud and pendant goes over THIRD. And the port after shroud and pendant goes over FOURTH. The fore stay goes over "ALL."

## CHAPTER VI.

"Long did I live on this poor legacy,
Till, tired with rocks and my own native sky,
To arts of navigation I inclined;
Observed the turns and changes of the wind:
Learned the fit havens, and began to note
The stormy Hyades, the rainy Goat,
The bright Taygete, and the shining Bears,
With all the sailor's catalogue of stars."—ADDISON.

### PROPORTION FOR A TWENTY-FIVE-TON CUTTER.

| | | | |
|---|---|---|---|
| Main shrouds | hemp | 4½in. | wire 2in. |
| Forestay | " | 6in. | wire 2½in. to 3in. |
| Main halliards | " | 2¾in. | |
| Purchase fall | " | 1¾in. | |
| Peak halliards | " | 2¾in. | |
| Purchase fall | " | 1¾in. | |
| Bowsprit shrouds | " | 3in. | wire 1⅝in. |
| Falls | " | 2in. | |
| Bobstay pendant | " | 4in. | wire 2in. |
| Bobstay fall | " | 2in. | |
| Topmast shrouds | " | 2½in. | wire 1in. |
| Topmast stay | " | 2½in. | wire 1in. |
| Topmast shroud falls | " | 1¾in. | |
| Jib halliards | " | 3in. | |
| Jib purchase | " | 1¾in. | |
| Main sheet | " | 3in. | |
| Boom topping lifts (double) | " | 3½in. | |
| Boom topping lifts (single) | " | 3in. | |
| Boom topping purchase | " | 1¾in. | |
| Reef pendants | " | 3in. | |
| Reef tackle | " | 2in. | |
| Gaff topsail halliard tie | " | 2½in. | |
| Gaff topsail halliard purchase | " | 1¾in. | |
| Gaff topsail sheets | " | 2½in. | |
| Jib sheets | " | 3in. | |
| To be made in the same way as recommended for a Fifty-ton Cutter. | | | |
| Fore sheets (double) | " | 1½in. | |
| Boom guy pendant | " | 3in. | |
| Boom guy purchase | " | 2in. | |
| Trysail sheets | " | 2in. | |
| Peak downhaul | " | 1in. | |

Main tack tricing line........................ hemp 1½in.
Gaff topsail clew line ........................ " 1½in.

The principal blocks required will be—

Main halliard blocks—one 6½in. double block, lower—one 6½in. treble block upper—two 3½in. double block, purchase.

Peak halliard blocks—five 5½in. single blocks,—one 3½in. double block purchase,—one 3½in. single block, purchase.

Main sheet blocks—one 6½in. treble block, boom,—one 6½in. double block horse,—two 3½in. single, quarters.

Jib halliard blocks—two 5½in. single blocks,—one 4in. single block, iron strapped, with large hook, one 3½in. double block, purchase,—one 3½in. single block, purchase.

Bowsprit shrouds—two 4in. double blocks,—two 4in. single blocks.

Bobstay—two 4in. single blocks.

Topmast stay—one 3in. single block, iron strapped, with long hook to clear traveller.

Fore sheets—four 3½in. single blocks.

Fore halliards—one 4in. single block—one 3in. single block.

Square sail yard—one 3½in. double block—one 3½in. single block.

Gaff topsail halliard, fly block—one 3in. single block.

Gaff topsail sheet—one 3in. single block.

Main tack tricing line—one 3in. single block.

Gaff topsail clewline—one 3in. single block.

Topmast rigging—eight 3in. single blocks.

Main tack tackle—one 3in. double block, two 3in. single blocks.

Gaff topsail tack—two 3in. single blocks.

Reef Tackle—one 4in. double block, one 4in. single block.

Burton—two 3½in. single blocks.

Runners and tackles—two 4in. single blocks, clump blocks—two 6in. sister blocks—two 3½in. single blocks, iron strapped, with hooks for rails.

One small brass gin block for gaff end, for ensign halliards and peak downhaul.

GROUND TACKLE :—

One best anchor, 2½ cwt. ; one second or working anchor, 2 cwt. ; one kedge anchor, ¾ cwt. One chain cable, ⅝in. link, 60 fathoms ; one 3in. hempen hawser.

The fitting of a purchase to the main-halliard of a twenty-five tonner, as also the treble upper block, and leading quarter blocks for the main-sheet, will be found as quickly valuable as they are on board a fifty-ton vessel.

There is nothing pertaining to a yacht that a yachtsman should be more particular about than the materials composing his running and standing rigging, for upon them very often his own life and the lives of his crew depend ;—niggardly economy has to my own knowledge been frequently exercised in this particular branch, and in all cases failure

ensued. It is the supremest folly in the world to imagine that a hull can be brought to perfection, launched, indifferently sparred, and worse rigged, and that success may be anticipated; it were better much for the peace of mind of her owner, and the reputation of her builder, that she remained where she "growed;" it is a great art, and a triumph of practical knowledge to bring a racing cutter out as she ought to be; and I am sorry to say that very few men there be that do it; however, more of this anon: I shall endeavour, in a future page, to explain the reason why.

With respect to the standing rigging, if it is to be hemp too much attention cannot be paid to it; the same does as equally apply to the running gear: therefore, do not rush to the first establishment at hand where rope is to be purchased, but seek out an established firm, one with a name and reputation, from whom you will obtain an article that you may depend your life upon, and not some well-dressed delusion, about equal in strength to a bad hay-band.

There is no trade, I do believe, in which there is more downright humbug practised than in rope making. The standing and running rigging of a vessel are analogous to the muscles and sinews of the human frame; if they be weak or delicate, "all is rotten in the state of Denmark." It may, therefore, not be out of place to give the yachtsman some insight into the rope-making business.

All ropes used to sustain the mainmast are fixed, such as the shrouds, forestay, and runner pendants, and are denominated the standing rigging; to these may be added the topmast shrouds, back stays, topmast stay, and bowsprit shrouds, which come properly under the same denomination.

The ropes running through blocks, and used in the different arrangement of the sails, and which are therefore moved according to the various circumstances of wind and weather, are called "running rigging," such are the main and peak halliards, fore and jib halliards, gaff topsail halliard, sheets, &c.

"Cordage" is the proper name for every description of rope used on board of a vessel.

Hemp and flax, or rather the bark, or external filaments, of these plants, are the only recognized materials used in the manufacture of rope; flax is only used for the smaller cordage up to an inch in circumference; but hemp for everything beyond that, and indeed it is preferred

for all cordage from the twine for a fishing net up to the cable of a line-of-battle ship.

Riga hemp—clean, is the best hemp known, and the dearest; its strength and flexibility united with a fine clean fibre entitles it to the first place; it is soft and silky, and of a clean yellow colour, with hardly any perceptible smell.

This description of hemp is called "clean," because it is the first of the crop pulled before the plant runs to seed, and when the external fibre is in its prime as to strength and flexibility, although it has not reached to its longest growth. This is called "staple" hemp.

Riga, "half clean" hemp, is the refuse and inferior hemp rejected from the "clean;" in the 3rd sec. of the Act 25, Geo. III., cap. 56, "For the more effectually preventing deceits and frauds in the manufacture of cordage, &c., it is enacted that every cable, hawser, &c., not wholly made of 'clean' hemp or 'staple,' is to be deemed inferior; and if hawser laid rope, or right hand rope (see Fig. 36), that is, laid from the 'right' to the 'left,' or with the sun—as we stand with our faces to the North—the sun rises on our right hand, or to the East, and sets on our left hand, or to the West—therefore this rope amongst seamen is called hawser laid, or right hand rope; laid with the sun—*i.e.*, that is, from right to left), one yarn is to be turned the backward way; and if cable laid rope, or left hand rope (see Fig. 37), that is, laid from 'left' to 'right,' or against the sun." "Three yarns" to be "turned" the "backward way," and in "each" case to "run" from "end" to "end." Yachtsmen will bear in mind that a rope is composed of threads of hemp called yarns.

A number of yarns twisted together form a "strand." Three strands twisted together, from right to left, form a "hawser laid rope."

And three "hawser laid ropes" twisted togother from "left to right," as Fig. 37, form a cable laid rope.

"Hawser laid ropes" should be coiled down from "right" to "left," or "with" the "sun:" "cable laid ropes" should be coiled down from "left" to "right," or "against" the "sun."

Riga "outshot" hemp is the produce of the second harvest, or when the plant has run to seed, the fibre has then arrived at its full growth, is hard and wiry to the finger, emits a strong sour odour, is very much reduced in strength and elasticity, compared with the clean hemp, and the fibres being longer and coarser, it will work up nearly a third more to

the advantage of the rope-maker than clean hemp; but then comes the trickery; being in a manner "spent," it has not the weight of "clean hemp," and to bring it up to this, it is doctored with rosin, and saturated with tar.

Oftentimes old rope is unlaid, the passable yarns selected, doctored as before, and laid up again with "out-shot" hemp.

Next to the Riga hemp comes the St. Petersburgh—"clean," "out-shot," and "half clean," after which comes Koningsburg, Archangel, Sweden, and Memel; and the most inferior hemp brought to the market is East Indian, called "Sunn," "Bombay," and "Jute." Of these jute is the worst of all; it is about the lightest hemp we have that can be used for cordage; and some idea of its strength may be conceived from the fact that when used for rope-making it will take nearly its own weight of tar to bring it up to the weight of staple cordage.

In the manufacture of rope the first process is the selection of the hemp; it is technically termed "hatchelling;" the long and short fibres are spun together for common yarns for topping, and is used for spinning "spun yarn;" for fine yarns a considerable proportion of the short fibres are left out, and the pure "clean" hemp is used.

Yarns are twisted of the size of from a 10th to a 12th of an inch in diameter: for common yarns, therefore, there would be from eighteen to twenty in the strand of a 3in. hawser laid rope, and for fine yarns twenty-five in the strand of a 3-in. hawser: thus there would be from fifty-four to sixty yarns in an ordinary rope: or seventy-five yarns in a fine rope of three inches in circumference, of three strands.

I have before me as I write a very beautiful piece of 3-in. shroud laid or "four strand rope," made especially for the use of yachts; it is part of some rope used for an 80-ton cutter for her topmast shrouds, topmast-stay, bowsprit shroud tackles, and shroud lanyards. There are four strands one inch and a quarter in circumference each, containing respectively fourteen yarns, or fifty-six yarns for the entire; the four strands are laid round a heart of 1-inch three strand line, containing in each strand two yarns. This is a very excellent specimen of rope, and "as shroud laid" or "four strand rope," is extensively used in yacht's rigging, 3-in. rope may be taken as a fair data to commence from. I quote these particulars as a guide, whereby to form a judgment of good or bad made rope.

A good and well-made rope when examined will present the following

appearance: the yarns composing the strands will appear to be spun even, solid, and round; they should not swell larger at one place more than another, nor be loosely spun at one portion, and then twisted hard immediately after; such yarns show bad and slovenly workmanship, and plain hemp, without being twisted at all, would be equally strong. There should not be too much tar, such as will clog the hands in great clots, exuding here and there, but it should be moderately and equally saturated, such as will leave a rich brown coating on the hands in the process of handling it. The strands will appear of a fair uniform roundness, each yarn composing the same laid so as to bear evenly together; if they are not laid so, water will penetrate the inner strands, which, consequently, will remain constantly wet, and very soon your rope will become rotten. A very dark-coloured rope is bad, as it shows that the yarns have been over-tarred, are probably not staple hemp, and that, in laying the rope to the pull hard, the tar has been pressed out of the yarns, and gives the rope this dark colour; on the other hand, a knowing rope-maker will not lay such yarns up to the pull-hard; so that a soft and yet good coloured rope will be the result; this is equally to be guarded against, for worse could not be. A sound, honest, well-made rope, will show out a clear good bright or yellowish brown colour, every yarn like wire, smooth, and without any roughness, or small fibre ends sticking out, the latter of which is a very average sign that inferior hemp has been used in the manufacture.

Three strand cable laid cordage of three inches in circumference will weigh as follows:—

| | cwt. | qrs. | lbs. |
|---|---|---|---|
| One-third of a cable is 40 fathoms, and weighs......... | 0 | 3 | 0 |
| Half a cable is 60 fathoms, and weighs .................. | 1 | 0 | 14 |
| Two-thirds of a cable is 80 fathoms, and weighs...... | 1 | 2 | 0 |
| A whole cable is 120 fathoms, and weighs............... | 2 | 1 | 0 |

"Three stand shroud or hawser laid" cordage of 3½ inches in circumference will weigh as follows:—

| | | | |
|---|---|---|---|
| Half a coil is 66 fathoms 4 feet, and weighs ........... | 1 | 1 | 25 |
| A whole coil is 133 fathoms 2 feet, and weighs ......... | 2 | 3 | 22 |

As I write, I have beside me some excellent specimens of rope which I saw an 80-ton cutter fitted out with; they are from the "Medina Rope Manufactory," Cowes, and are labelled "Cowes Staple."

As these ropes were manufactured at the head-quarters of yachtsmen, or at least from its reputation what it should be; and as they were ordered as the best that money could procure in Great Britain or Ireland, I give their dimensions, in detail, as a fair guide for yachtsmen to go by.

No. 1 is 1¾in. hemp rope, three strand, hawser laid; in each strand there are seven yarns, of one-tenth of an inch in diameter, twenty-one yarns in the rope. It was used for "peak" and "jib" down hauls; "lifts" and "braces" for cross-jack-yards, and for the "lacings."

No. 2 is 2¼in. hemp rope, three strand, hawser laid; in each strand there are thirteen yarns of one-tenth of an inch in diameter, thirty-nine yarns in the rope. It was used for tackles, and topmast shroud tackles.

No. 3 is 2¾in. hemp rope, four strand, shroud laid; in each strand there are twelve yarns, of one-tenth of an inch in diameter, forty-eight yarns in the rope; the four strands are laid round a heart of ¾in. three strand line, each strand being composed of a single yarn, of full an eighth of an inch in diameter. It was used for gaff-topsail, and foresail halliards,

No. 4 is a 3-in. hemp rope, four strand, shroud laid; in each strand there are twelve yarns of one-tenth of an inch in diameter, forty-eight yarns in the rope; the four strands are laid round a heart one inch three strand line, each strand being composed of two yarns. This rope was used for "fore-sheets," "trysail-sheets," "lift," and "peak purchase tackles."

No. 5 is a 3-in. hemp rope, four strand, shroud laid; in each strand there are fourteen yarns, fifty-six yarns in the entire; the four strands are laid round a heart of one inch three strand line, containing in each strand two yarns. This rope was used for "topmast shrouds," "topmast stay," "bowsprit shroud tackles," and "main-shroud lanyard."

No. 6 is a 3¾in. hemp rope, four strand, shroud laid; in each strand there are twenty-five yarns, 100 yarns in the entire rope; the four strands are laid round a heart of full one inch line, of three strands, hawser laid, each strand being composed of two yarns. It was used for the main and peak halliards.

No. 7 is 4-in. hemp rope, four strand, shroud laid; in each strand there are twenty-six yarns, 104 in the entire rope; the four strands are

laid round a heart of 1¼-inch line, of three strands, hawser laid, each strand being composed of three yarns. This rope is wormed with ¼-inch three strand line, each strand containing four yarns, of about the twelfth of an inch in diameter. It was used for "pendant runners."

No. 8 is 5½-inch hemp rope, four strand, shroud laid; in each strand there are fifty-six yarns, 224 yarns in the entire rope; the four strands are laid round a heart of 1¼-inch line of three strands, hawser laid, each strand containing four yarns. This rope is wormed with ¾-inch line, of three strands, hawser laid, each strand containing two yarns. This rope was used for the main shrouds.

The foregoing are the details of eight specimens of first-class hempen cordage, manufactured specially for yachts' use. I now shall give some details of Manilla rope, from the same maker.

No. 1 is a 4¼-inch Manilla rope, four strand, shroud laid; in each strand there are twenty-two yarns, eighty-eight in the entire rope; the four strands are laid round a heart of 1¼-inch "hemp" line, three strands, hawser laid, each strand containing three yarns. This was used for "reef pendants."

No. 2 is 4-inch Manilla rope, four strand, shroud laid; in each strand there are twenty yarns, eighty yarns in the entire rope; the four strands are laid round a heart of 1¼-inch "hemp" line, three strand, hawser laid, each strand containing two yarns. This rope was used for boom topping lifts.

No. 3 is 3¾ inch Manilla rope, four strand, shroud laid; in each strand there are twenty yarns, eighty yarns in the entire rope; the four strands are laid round a heart of 1¼-inch hemp line, three strand, hawser laid, each strand containing two yarns. This rope was used for jib halliards.

No. 4 is a 3¾-inch Manilla rope, four strand, "cable" laid; in each strand there are twenty-two yarns, eighty-eight yarns in the entire rope; the four strands are laid round a heart of 1¼-inch hemp rope, three strand, hawser laid, each strand containing three yarns. This is a very beautiful rope, and was made specially for "main-sheet."

In the twisting of the yarns of this rope, in each strand there are six yarns laid from the left to the right, and sixteen yarns laid from the right to the left.

I here subjoin very useful Tables, showing the weight of the lengths of three strand hawser laid cordage, from three-quarters of an inch to twelve inches in circumference, in fathoms, coils, and half coils.

| | ¾-in. Rope. | | | | | 1¾-in. Rope. | | | | | 2½-in. Rope. | | | | | 3¼-in. Rope. | | | | | 4-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | |
| | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. |
| | 1 | 0 | 0 | 0 | 3⅞ | 1 | 0 | 0 | 0 | 11¾ | 1 | 0 | 0 | 1 | 7¾ | 1 | 0 | 0 | 2 | 7¼ | 1 | 0 | 0 | 3 | 15¼ |
| | 5 | 0 | 0 | 1 | 3¾ | 5 | 0 | 0 | 3 | 11¼ | 5 | 0 | 0 | 7 | 6¾ | 5 | 0 | 0 | 12 | 6 | 5 | 0 | 0 | 19 | 12¾ |
| | 10 | 0 | 0 | 2 | 7½ | 10 | 0 | 0 | 7 | 6¾ | 10 | 0 | 0 | 14 | 13½ | 10 | 0 | 0 | 24 | 12 | 10 | 0 | 1 | 12 | 9½ |
| | 20 | 0 | 0 | 4 | 15 | 20 | 0 | 0 | 14 | 13½ | 20 | 0 | 1 | 1 | 11 | 20 | 0 | 1 | 21 | 8 | 20 | 0 | 2 | 23 | 3 |
| | 30 | 0 | 0 | 7 | 6½ | 30 | 0 | 0 | 22 | 4¼ | 30 | 0 | 1 | 16 | 8½ | 30 | 0 | 2 | 18 | 4 | 30 | 1 | 0 | 6 | 12½ |
| | 40 | 0 | 0 | 9 | 14 | 40 | 0 | 1 | 1 | 11 | 40 | 0 | 2 | 3 | 6 | 40 | 0 | 3 | 15 | 0 | 40 | 1 | 1 | 18 | 6 |
| | 50 | 0 | 0 | 12 | 5½ | 50 | 0 | 1 | 9 | 1¾ | 50 | 0 | 2 | 18 | 3½ | 50 | 1 | 0 | 11 | 12 | 50 | 1 | 3 | 1 | 15½ |
| | 60 | 0 | 0 | 14 | 13 | 60 | 0 | 1 | 16 | 8½ | 60 | 0 | 3 | 5 | 1 | 60 | 1 | 1 | 8 | 8 | 60 | 2 | 0 | 13 | 9 |
| Half coil ... | 66–4 | 0 | 0 | 16 | 8 | 66–4 | 0 | 1 | 21 | 8 | 66–4 | 0 | 3 | 15 | 0 | 66–4 | 1 | 1 | 25 | 0 | 66–4 | 2 | 1 | 12 | 0 |
| | 70 | 0 | 0 | 17 | 4½ | 70 | 0 | 1 | 23 | 15¼ | 70 | 0 | 3 | 19 | 14½ | 70 | 1 | 2 | 5 | 4 | 70 | 2 | 1 | 25 | 2½ |
| | 80 | 0 | 0 | 19 | 12 | 80 | 0 | 2 | 3 | 6 | 80 | 1 | 0 | 6 | 12 | 80 | 1 | 3 | 2 | 0 | 80 | 2 | 3 | 8 | 12 |
| | 90 | 0 | 0 | 22 | 3½ | 90 | 0 | 2 | 10 | 12¾ | 90 | 1 | 0 | 21 | 9½ | 90 | 1 | 3 | 26 | 12 | 90 | 3 | 0 | 20 | 5½ |
| | 100 | 0 | 0 | 24 | 11 | 100 | 0 | 2 | 18 | 3½ | 100 | 1 | 1 | 8 | 7 | 100 | 2 | 0 | 23 | 8 | 100 | 3 | 2 | 3 | 15 |
| | 110 | 0 | 0 | 27 | 2½ | 110 | 0 | 2 | 25 | 10¼ | 110 | 1 | 1 | 23 | 4½ | 110 | 2 | 1 | 20 | 4 | 110 | 3 | 3 | 15 | 8½ |
| | 120 | 0 | 1 | 1 | 10 | 120 | 0 | 3 | 5 | 1 | 120 | 1 | 2 | 10 | 2 | 120 | 2 | 2 | 17 | 0 | 120 | 4 | 0 | 26 | 2 |
| Whole coil. | 133-2 | 0 | 1 | 5 | 0 | 133–2 | 0 | 3 | 15 | 0 | 133–2 | 1 | 3 | 2 | 0 | 133–2 | 2 | 3 | 22 | 0 | 133–2 | 4 | 2 | 24 | 0 |

| | 1-in. Rope. | | | | | 2-in. Rope. | | | | | 2¾-in. Rope. | | | | | 3½-in. Rope. | | | | | 4½-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 0 | 5¾ | 1 | 0 | 0 | 0 | 15¾ | 1 | 0 | 0 | 1 | 13¼ | 1 | 0 | 0 | 2 | 12 | 1 | 0 | 0 | 4 | 6¾ |
| | 5 | 0 | 0 | 1 | 13¼ | 5 | 0 | 0 | 4 | 15 | 5 | 0 | 0 | 9 | 4 | 5 | 0 | 0 | 13 | 12¾ | 5 | 0 | 0 | 22 | 2 |
| | 10 | 0 | 0 | 3 | 10¾ | 10 | 0 | 0 | 9 | 14¼ | 10 | 0 | 0 | 18 | 8¼ | 10 | 0 | 0 | 27 | 9¼ | 10 | 0 | 1 | 16 | 4 |
| | 20 | 0 | 0 | 7 | 5½ | 20 | 0 | 0 | 19 | 12½ | 20 | 0 | 1 | 0 | 9½ | 20 | 0 | 1 | 27 | 2½ | 20 | 0 | 3 | 4 | 8 |
| | 30 | 0 | 0 | 11 | 0¼ | 30 | 0 | 1 | 1 | 10¾ | 30 | 0 | 1 | 27 | 8¾ | 30 | 0 | 2 | 16 | 11¾ | 30 | 1 | 0 | 20 | 12 |
| | 40 | 0 | 0 | 14 | 11 | 40 | 0 | 1 | 11 | 9 | 40 | 0 | 2 | 18 | 1 | 40 | 0 | 3 | 26 | 5 | 40 | 1 | 2 | 9 | 0 |
| | 50 | 0 | 0 | 18 | 5¾ | 50 | 0 | 1 | 21 | 7¼ | 50 | 0 | 3 | 8 | 9¼ | 50 | 1 | 0 | 25 | 14¼ | 50 | 1 | 3 | 25 | 4 |
| | 60 | 0 | 0 | 22 | 0½ | 60 | 0 | 2 | 3 | 5½ | 60 | 0 | 3 | 27 | 1½ | 60 | 1 | 1 | 25 | 7½ | 60 | 2 | 1 | 13 | 8 |
| Half coil ... | 66–4 | 0 | 0 | 24 | 8 | 66–4 | 0 | 2 | 10 | 0 | 66–4 | 1 | 0 | 11 | 8 | 66–4 | 1 | 2 | 16 | 0 | 66–4 | 2 | 2 | 15 | 0 |

| | 1-in. Rope. | | | | | 2-in. Rope. | | | | | 2¾-in. Rope. | | | | | 3½-in. Rope. | | | | | 4¼-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Lengths in fatnom. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. |
| | 70 | 0 | 0 | 25 | 11¾ | 70 | 0 | 2 | 13 | 3¾ | 70 | 1 | 0 | 17 | 9¾ | 70 | 1 | 2 | 25 | 0¼ | 70 | 2 | 3 | 1 | 12 |
| | 80 | 0 | 1 | 1 | 6 | 80 | 0 | 2 | 23 | 2 | 80 | 1 | 1 | 8 | 2 | 80 | 1 | 3 | 24 | 10 | 80 | 3 | 0 | 18 | 0 |
| | 90 | 0 | 1 | 5 | 0¾ | 90 | 0 | 3 | 5 | 0¼ | 90 | 1 | 1 | 26 | 10¼ | 90 | 2 | 0 | 24 | 3¼ | 90 | 3 | 2 | 6 | 4 |
| | 100 | 0 | 1 | 8 | 11⅛ | 100 | 0 | 3 | 14 | 14⅛ | 100 | 1 | 2 | 17 | 2⅛ | 100 | 2 | 1 | 23 | 12½ | 100 | 3 | 3 | 22 | 8 |
| | 110 | 0 | 1 | 12 | 6¼ | 110 | 0 | 3 | 24 | 12⅜ | 110 | 1 | 3 | 7 | 10¾ | 110 | 2 | 2 | 23 | 5⅜ | 120 | 4 | 1 | 10 | 12 |
| | 120 | 0 | 1 | 16 | 1 | 120 | 1 | 0 | 6 | 11 | 120 | 1 | 3 | 26 | 3 | 120 | 2 | 3 | 22 | 15 | 130 | 4 | 2 | 27 | 0 |
| Whole coil. | 133-2 | 0 | 1 | 21 | 0 | 133-2 | 1 | 0 | 20 | 0 | 133-2 | 2 | 0 | 23 | 0 | 133-2 | 3 | 1 | 4 | 0 | 133-2 | 5 | 1 | 2 | 0 |

| | 1½-in. Rope. | | | | | 2¼-in. Rope. | | | | | 3-in. Rope. | | | | | 3¾-in. Rope. | | | | | 4½-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 0 | 7¾ | 1 | 0 | 0 | 1 | 3½ | 1 | 0 | 0 | 2 | 3½ | 1 | 0 | 0 | 3 | 3½ | 1 | 0 | 0 | 4 | 15¼ |
| | 5 | 0 | 0 | 2 | 7½ | 5 | 0 | 0 | 6 | 3 | 5 | 0 | 0 | 11 | 2 | 5 | 0 | 0 | 16 | 2¼ | 5 | 0 | 0 | 24 | 12 |
| | 10 | 0 | 0 | 4 | 15 | 10 | 0 | 0 | 12 | 6 | 10 | 0 | 0 | 22 | 4¼ | 10 | 0 | 1 | 4 | 2¾ | 10 | 0 | 1 | 21 | 8 |
| | 20 | 0 | 0 | 9 | 14 | 20 | 0 | 0 | 24 | 12 | 20 | 0 | 1 | 16 | 8½ | 20 | 0 | 2 | 8 | 5½ | 20 | 0 | 3 | 15 | 0 |
| | 30 | 0 | 0 | 14 | 13 | 30 | 0 | 1 | 9 | 2 | 30 | 0 | 2 | 10 | 12¼ | 30 | 0 | 3 | 12 | 8¼ | 30 | 1 | 1 | 8 | 8 |
| | 40 | 0 | 0 | 19 | 12 | 40 | 0 | 1 | 21 | 8 | 40 | 0 | 3 | 5 | 1 | 40 | 1 | 0 | 16 | 11 | 40 | 1 | 3 | 2 | 0 |
| | 50 | 0 | 0 | 24 | 11 | 50 | 0 | 2 | 5 | 14 | 50 | 0 | 3 | 27 | 5¼ | 50 | 1 | 1 | 20 | 13¾ | 50 | 2 | 0 | 32 | 8 |
| | 60 | 0 | 1 | 1 | 10 | 60 | 0 | 2 | 18 | 4 | 60 | 1 | 0 | 21 | 9½ | 60 | 1 | 2 | 25 | 0½ | 60 | 2 | 2 | 17 | 0 |
| Half-coil ... | 66-4 | 0 | 1 | 5 | 0 | 66-4 | 0 | 2 | 26 | 8 | 66-4 | 1 | 1 | 8 | 8 | 66-4 | 1 | 3 | 18 | 8 | 66-4 | 2 | 3 | 22 | 0 |
| | 70 | 0 | 1 | 6 | 9 | 70 | 0 | 3 | 2 | 10 | 70 | 1 | 1 | 15 | 13¾ | 70 | 2 | 0 | 1 | 3¼ | 70 | 3 | 0 | 10 | 8 |
| | 80 | 0 | 1 | 11 | 8 | 80 | 0 | 3 | 15 | 0 | 80 | 1 | 2 | 10 | 2 | 80 | 2 | 1 | 5 | 6 | 80 | 3 | 2 | 4 | 0 |
| | 90 | 0 | 1 | 16 | 7 | 90 | 0 | 3 | 27 | 6 | 90 | 1 | 3 | 4 | 6¼ | 90 | 2 | 2 | 9 | 8¾ | 90 | 3 | 3 | 25 | 8 |
| | 100 | 0 | 1 | 21 | 6 | 100 | 1 | 0 | 11 | 12 | 100 | 1 | 3 | 26 | 10½ | 100 | 2 | 3 | 13 | 11½ | 100 | 4 | 1 | 19 | 0 |
| | 110 | 0 | 1 | 26 | 5 | 110 | 1 | 0 | 24 | 2 | 110 | 2 | 0 | 20 | 14¼ | 110 | 3 | 0 | 17 | 14¼ | 110 | 4 | 3 | 12 | 8 |
| | 120 | 0 | 2 | 3 | 4 | 120 | 1 | 1 | 8 | 8 | 120 | 2 | 1 | 15 | 3 | 120 | 3 | 1 | 21 | 17 | 120 | 5 | 1 | 6 | 0 |
| Whole coil. | 133-2 | 0 | 2 | 10 | 0 | 133-2 | 1 | 1 | 25 | 0 | 133-2 | 2 | 2 | 17 | 0 | 133-2 | 3 | 3 | 9 | 0 | 133-2 | 5 | 3 | 16 | 0 |

| | 4¾-in. Rope. | | | | | 5½-in. Rope. | | | | | 6¼-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. |
| | 1 | 0 | 0 | 5 | 9 | 1 | 0 | 0 | 7 | 6¾ | 5 | 0 | 0 | 9 | 10¼ |
| | 5 | 0 | 0 | 27 | 13¼ | 5 | 0 | 1 | 9 | 2 | 1 | 0 | 1 | 20 | 4 |
| | 10 | 0 | 1 | 27 | 10½ | 10 | 0 | 2 | 18 | 4 | 10 | 0 | 3 | 12 | 8¼ |
| | 20 | 0 | 3 | 27 | 4¾ | 20 | 1 | 1 | 8 | 8 | 20 | 1 | 2 | 25 | 0½ |
| | 30 | 1 | 1 | 26 | 15¼ | 30 | 1 | 3 | 26 | 12 | 30 | 2 | 2 | 9 | 8¾ |
| | 40 | 1 | 3 | 26 | 9½ | 40 | 2 | 2 | 17 | 0 | 40 | 3 | 1 | 22 | 1 |
| | 50 | 2 | 1 | 26 | 3 | 50 | 3 | 1 | 7 | 4 | 50 | 4 | 1 | 6 | 9¼ |
| | 60 | 2 | 3 | 25 | 13¼ | 60 | 3 | 3 | 25 | 8 | 60 | 5 | 0 | 19 | 1½ |
| Half coil ... | 66-4 | 3 | 1 | 7 | 0 | 66-4 | 4 | 1 | 19 | 0 | 66-4 | 5 | 2 | 27 | 8 |
| | 70 | 3 | 1 | 25 | 7¾ | 70 | 4 | 2 | 15 | 12 | 70 | 6 | 0 | 3 | 9¾ |
| | 80 | 3 | 3 | 25 | 2¼ | 80 | 5 | 1 | 6 | 0 | 80 | 6 | 3 | 16 | 2 |
| | 90 | 4 | 1 | 24 | 12½ | 90 | 5 | 3 | 24 | 4 | 90 | 7 | 3 | 0 | 10½ |
| | 100 | 4 | 3 | 24 | 7 | 100 | 6 | 2 | 14 | 8 | 100 | 8 | 2 | 13 | 2½ |
| | 110 | 5 | 1 | 24 | 1¼ | 110 | 7 | 1 | 4 | 12 | 110 | 9 | 1 | 25 | 10¾ |
| | 120 | 5 | 3 | 23 | 11¾ | 120 | 7 | 3 | 23 | 0 | 120 | 10 | 1 | 10 | 2 |
| Whole coil. | 133-2 | 6 | 2 | 14 | 0 | 133-2 | 8 | 3 | 10 | 0 | 133-2 | 11 | 1 | 27 | 0 |

| | 7-in. Rope. | | | | | 7¾-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. |
| | 1 | 0 | 0 | 12 | 2 | 1 | 0 | 0 | 14 | 13½ |
| | 5 | 0 | 2 | 4 | 10 | 5 | 0 | 2 | 18 | 4 |
| | 10 | 1 | 0 | 9 | 4½ | 10 | 1 | 1 | 8 | 8 |
| | 20 | 2 | 0 | 18 | 8½ | 20 | 2 | 2 | 17 | 0 |
| | 30 | 3 | 0 | 27 | 12¾ | 30 | 3 | 3 | 25 | 8 |
| | 40 | 4 | 1 | 9 | 5 | 40 | 5 | 1 | 6 | 0 |
| | 50 | 5 | 1 | 18 | 9½ | 50 | 6 | 2 | 14 | 8 |
| | 60 | 6 | 1 | 27 | 13½ | 60 | 7 | 3 | 23 | 0 |
| Half coil ... | 66-4 | 7 | 0 | 24 | 8 | 66-4 | 9 | 3 | 10 | 0 |
| | 70 | 7 | 2 | 9 | 1¾ | 70 | 8 | 1 | 3 | 8 |
| | 80 | 8 | 2 | 18 | 6 | 80 | 10 | 2 | 12 | 0 |
| | 90 | 9 | 2 | 27 | 10¼ | 90 | 11 | 3 | 20 | 8 |
| | 100 | 10 | 3 | 8 | 14½ | 100 | 13 | 1 | 1 | 0 |
| | 110 | 11 | 3 | 18 | 2¼ | 110 | 14 | 2 | 9 | 8 |
| | 120 | 12 | 3 | 27 | 7 | 120 | 15 | 3 | 18 | 0 |
| Whole coil. | 133-2 | 14 | 1 | 21 | 0 | 133-2 | 17 | 2 | 20 | 0 |

| | 5-in. Rope. | | | | | 5¾-in. Rope. | | | | | 6½-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 6 | 3 | 1 | 0 | 0 | 8 | 0¼ | 1 | 0 | 0 | 10 | 6¼ |
| | 5 | 0 | 1 | 2 | 15 | 5 | 0 | 1 | 12 | 1½ | 5 | 0 | 1 | 23 | 15½ |
| | 10 | 0 | 2 | 5 | 14 | 10 | 0 | 2 | 25 | 10¾ | 10 | 0 | 3 | 19 | 5 |
| | 20 | 1 | 0 | 11 | 12 | 20 | 1 | 1 | 23 | 5½ | 20 | 1 | 3 | 11 | 14 |
| | 30 | 1 | 2 | 17 | 10 | 30 | 2 | 0 | 21 | 0¼ | 30 | 2 | 3 | 3 | 13 |
| | 40 | 2 | 0 | 23 | 8 | 40 | 2 | 3 | 18 | 11¼ | 40 | 3 | 2 | 23 | 12 |
| | 50 | 2 | 3 | 1 | 6 | 50 | 3 | 2 | 16 | 6 | 50 | 4 | 2 | 15 | 11 |
| | 60 | 3 | 1 | 7 | 4 | 60 | 4 | 1 | 14 | 0¾ | 60 | 5 | 2 | 7 | 10 |
| Half coil ... | 66-4 | 3 | 2 | 20 | 8 | 66-4 | 4 | 3 | 12 | 8 | 66-4 | 6 | 0 | 21 | 0 |

| | 7¼-in. Rope. | | | | | 8-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 13 | 0 | 1 | 0 | 0 | 15 | 13¼ |
| | 5 | 0 | 2 | 8 | 15¾ | 5 | 0 | 2 | 23 | 3 |
| | 10 | 1 | 0 | 17 | 15½ | 10 | 1 | 1 | 18 | 6¼ |
| | 20 | 2 | 1 | 7 | 15 | 20 | 2 | 0 | 8 | 12½ |
| | 30 | 3 | 1 | 25 | 14½ | 30 | 4 | 0 | 27 | 2¾ |
| | 44 | 4 | 2 | 15 | 14 | 40 | 5 | 2 | 17 | 9 |
| | 50 | 5 | 3 | 5 | 13½ | 50 | 7 | 0 | 7 | 15¼ |
| | 60 | 6 | 3 | 23 | 13 | 60 | 8 | 1 | 26 | 5½ |
| Half coil ... | 66-4 | 7 | 2 | 26 | 0 | 66-4 | 9 | 1 | 20 | 0 |

| | 5-in. Rope. | | | | | 5¾-in. Rope. | | | | | 6½-in. Rope. | | | | | 7¼-in. Rope. | | | | | 8-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. |
| | 70 | 3 | 3 | 13 | 2 | 70 | 5 | 0 | 11 | 11½ | 70 | 6 | 1 | 27 | 9 | 70 | 8 | 0 | 13 | 12½ | 70 | 9 | 3 | 16 | 11¾ |
| | 80 | 4 | 1 | 19 | 0 | 80 | 5 | 3 | 9 | 6½ | 80 | 7 | 1 | 19 | 1 | 80 | 9 | 1 | 3 | 12 | 80 | 11 | 1 | 7 | 2 |
| | 90 | 4 | 3 | 24 | 14 | 90 | 6 | 2 | 7 | 1¼ | 90 | 8 | 1 | 11 | 7 | 90 | 10 | 1 | 21 | 11½ | 90 | 12 | 2 | 25 | 8¼ |
| | 100 | 5 | 2 | 2 | 12 | 100 | 7 | 1 | 4 | 12 | 100 | 9 | 1 | 3 | 6 | 100 | 11 | 2 | 11 | 11 | 100 | 14 | 0 | 15 | 14½ |
| | 110 | 6 | 0 | 8 | 10 | 110 | 8 | 0 | 2 | 6¾ | 110 | 10 | 0 | 23 | 5 | 110 | 12 | 3 | 1 | 10½ | 110 | 15 | 2 | 6 | 4¾ |
| | 120 | 6 | 2 | 14 | 8 | 120 | 8 | 3 | 0 | 1½ | 120 | 11 | 0 | 15 | 4 | 120 | 13 | 3 | 19 | 10 | 120 | 16 | 3 | 24 | 11 |
| Whole coil. | 132-2 | 7 | 1 | 13 | 0 | 133-2 | 9 | 2 | 25 | 0 | 133-2 | 12 | 1 | 14 | 0 | 133-2 | 15 | 1 | 24 | 0 | 133-2 | 18 | 3 | 12 | 0 |

| | 5¼-in. Rope. | | | | | 6-in. Rope. | | | | | 6¾-in. Rope. | | | | | 7½ in. Rope. | | | | | 8¼-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 6 | 13 | 1 | 0 | 0 | 8 | 14½ | 1 | 0 | 0 | 11 | 2¼ | 1 | 0 | 0 | 13 | 13¾ | 1 | 0 | 0 | 16 | 13¼ |
| | 5 | 0 | 1 | 6 | 1¼ | 5 | 0 | 1 | 16 | 8¼ | 5 | 0 | 1 | 27 | 11 | 5 | 0 | 2 | 13 | 4¾ | 5 | 0 | 3 | 8 | 2¼ |
| | 10 | 0 | 2 | 12 | 2¾ | 10 | 0 | 3 | 5 | 1½ | 10 | 0 | 3 | 27 | 6 | 10 | 1 | 0 | 26 | 9½ | 10 | 1 | 2 | 0 | 4¾ |
| | 20 | 1 | 0 | 24 | 5½ | 20 | 1 | 2 | 10 | 3 | 20 | 1 | 3 | 26 | 12 | 20 | 2 | 1 | 25 | 3 | 20 | 3 | 0 | 0 | 9½ |
| | 30 | 1 | 3 | 8 | 8¼ | 30 | 2 | 1 | 15 | 4½ | 30 | 2 | 3 | 26 | 2 | 30 | 3 | 2 | 23 | 12½ | 30 | 4 | 2 | 0 | 14¼ |
| | 40 | 2 | 1 | 20 | 11 | 40 | 3 | 0 | 20 | 6 | 40 | 3 | 3 | 25 | 8 | 40 | 4 | 3 | 22 | 6 | 40 | 6 | 0 | 1 | 3 |
| | 50 | 3 | 0 | 4 | 13¾ | 50 | 3 | 3 | 15 | 7½ | 50 | 4 | 3 | 24 | 14 | 50 | 6 | 0 | 20 | 15½ | 50 | 7 | 2 | 1 | 7¾ |
| | 60 | 3 | 2 | 0 | 17½ | 60 | 4 | 3 | 2 | 9 | 60 | 5 | 3 | 24 | 4 | 60 | 7 | 1 | 19 | 9 | 60 | 9 | 0 | 1 | 12½ |
| Half coil ... | 66-4 | 4 | 0 | 6 | 8 | 66-4 | 5 | 1 | 6 | 0 | 66-4 | 6 | 2 | 14 | 8 | 66-4 | 8 | 1 | 0 | 0 | 66-4 | 10 | 0 | 2 | 0 |
| | 70 | 4 | 1 | 1 | 3¼ | 70 | 5 | 2 | 7 | 10½ | 70 | 6 | 3 | 23 | 10 | 70 | 8 | 2 | 18 | 2½ | 70 | 10 | 2 | 2 | 1¼ |
| | 80 | 4 | 3 | 13 | 6 | 80 | 6 | 1 | 12 | 12 | 80 | 7 | 3 | 23 | 0 | 80 | 9 | 3 | 16 | 12 | 80 | 12 | 0 | 26 | 0 |
| | 90 | 5 | 1 | 25 | 8¾ | 90 | 7 | 0 | 17 | 13½ | 900 | 8 | 3 | 22 | 6 | 90 | 11 | 0 | 15 | 5½ | 90 | 13 | 2 | 2 | 10¾ |
| | 100 | 6 | 0 | 9 | 11½ | 100 | 7 | 3 | 22 | 15 | 100 | 9 | 3 | 21 | 12 | 10 | 12 | 1 | 13 | 5 | 100 | 15 | 0 | 2 | 15½ |
| | 110 | 6 | 2 | 21 | 14¼ | 110 | 8 | 3 | 0 | 0½ | 110 | 10 | 3 | 21 | 2 | 110 | 13 | 2 | 12 | 8½ | 110 | 16 | 2 | 3 | 4¼ |
| | 120 | 7 | 1 | 6 | 1 | 120 | 9 | 2 | 5 | 2 | 120 | 11 | 3 | 20 | 8 | 120 | 14 | 3 | 11 | 12 | 120 | 18 | 0 | 3 | 9 |
| Whole coil. | 133-2 | 8 | 0 | 13 | 0 | 133-2 | 10 | 2 | 12 | 0 | 133-2 | 13 | 1 | 1 | 0 | 133-2 | 16 | 2 | 0 | 0 | 133-2 | 20 | 0 | 4 | 0 |

| | 8½-in. Rope. | | | | | 9¼-in. Rope. | | | | | 10-in. Rope. | | | | | 10¾-in. Rope. | | | | | 11½-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | | Length in fathoms. | Weight. | | | |
| | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. | | c. | qr. | lb. | oz. |
| | 1 | 0 | 0 | 17 | 13 | 1 | 0 | 0 | 20 | 5¼ | 1 | 0 | 0 | 24 | 12 | 1 | 0 | 1 | 0 | 7¼ | 1 | 0 | 1 | 4 | 10¾ |
| | 5 | 0 | 3 | 5 | 1½ | 5 | 0 | 3 | 17 | 10 | 5 | 1 | 0 | 11 | 12 | 5 | 1 | 1 | 2 | 5 | 5 | 1 | 1 | 23 | 5½ |
| | 10 | 1 | 2 | 10 | 3 | 10 | 1 | 3 | 7 | 4 | 10 | 2 | 0 | 23 | 8 | 10 | 2 | 2 | 4 | 10 | 10 | 2 | 3 | 18 | 11 |
| | 20 | 3 | 0 | 20 | 6 | 20 | 3 | 2 | 14 | 8 | 20 | 4 | 1 | 19 | 0 | 20 | 5 | 0 | 9 | 4 | 20 | 5 | 3 | 9 | 6 |
| | 30 | 4 | 3 | 2 | 9 | 30 | 5 | 1 | 21 | 12 | 30 | 6 | 2 | 14 | 8 | 30 | 7 | 2 | 13 | 4 | 30 | 8 | 3 | 0 | 1 |
| | 40 | 6 | 1 | 12 | 12 | 40 | 7 | 1 | 0 | 0 | 40 | 8 | 3 | 10 | 0 | 40 | 10 | 0 | 18 | 8 | 40 | 11 | 2 | 18 | 11 |
| | 50 | 7 | 3 | 22 | 15 | 50 | 9 | 0 | 7 | 4 | 50 | 11 | 0 | 5 | 8 | 50 | 12 | 2 | 23 | 2 | 50 | 14 | 2 | 9 | 7 |
| | 60 | 9 | 2 | 5 | 2 | 60 | 10 | 3 | 14 | 8 | 60 | 13 | 1 | 1 | 0 | 60 | 15 | 0 | 27 | 12 | 60 | 17 | 2 | 0 | 2 |
| Half coil ... | 66-4 | 10 | 1 | 12 | 0 | 66-4 | 12 | 0 | 11 | 0 | 66-4 | 14 | 2 | 26 | 0 | 66-4 | 16 | 3 | 21 | 8 | 66-4 | 19 | 1 | 22 | 0 |
| | 70 | 11 | 0 | 15 | 5 | 70 | 12 | 2 | 21 | 12 | 70 | 15 | 1 | 24 | 8 | 70 | 17 | 3 | 14 | 6 | 70 | 20 | 1 | 18 | 3 |
| | 80 | 12 | 2 | 25 | 8 | 80 | 14 | 2 | 1 | 0 | 80 | 17 | 2 | 20 | 0 | 80 | 20 | 1 | 9 | 0 | 80 | 23 | 1 | 9 | 8 |
| | 90 | 14 | 1 | 7 | 11 | 90 | 16 | 1 | 8 | 4 | 90 | 19 | 3 | 15 | 8 | 90 | 22 | 3 | 13 | 10 | 90 | 26 | 1 | 0 | 3 |
| | 100 | 15 | 3 | 17 | 4 | 100 | 18 | 0 | 15 | 8 | 100 | 22 | 0 | 11 | 0 | 100 | 25 | 1 | 18 | 4 | 100 | 29 | 0 | 18 | 14 |
| | 110 | 17 | 2 | 0 | 1 | 110 | 19 | 2 | 23 | 0 | 110 | 24 | 1 | 6 | 8 | 110 | 27 | 3 | 22 | 14 | 110 | 32 | 0 | 9 | 9 |
| | 120 | 19 | 0 | 10 | 4 | 120 | 21 | 3 | 2 | 4 | 120 | 26 | 2 | 2 | 0 | 120 | 30 | 1 | 27 | 8 | 120 | 35 | 0 | 4 | 4 |
| Whole coil. | 133-2 | 21 | 0 | 24 | 0 | 133-2 | 24 | 0 | 22 | 0 | 133-2 | 29 | 1 | 24 | 0 | 133-2 | 33 | 3 | 15 | 0 | 133-2 | 38 | 3 | 16 | 0 |

| | 8¾-in. Rope. | | | | | 9½-in. Rope. | | | | | 10¼-in. Rope. | | | | | 11-in. Rope. | | | | | 11¾-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 3 | 18 | 14½ | 1 | 0 | 0 | 22 | 4½ | 1 | 0 | 0 | 26 | 0 | 1 | 0 | 1 | 1 | 1¾ | 1 | 0 | 1 | 6 | 2½ |
| | 5 | 0 | 3 | 10 | 9 | 5 | 0 | 3 | 27 | 6 | 5 | 1 | 0 | 27 | 15 | 5 | 1 | 1 | 5 | 9 | 5 | 1 | 2 | 2 | 12¼ |
| | 10 | 1 | 2 | 21 | 2¼ | 10 | 1 | 3 | 26 | 12 | 10 | 2 | 1 | 7 | 14 | 10 | 2 | 2 | 11 | 2¼ | 10 | 3 | 0 | 5 | 8¾ |
| | 20 | 3 | 1 | 14 | 4½ | 20 | 3 | 3 | 25 | 8 | 20 | 4 | 2 | 15 | 12 | 20 | 5 | 0 | 22 | 4½ | 20 | 6 | 0 | 11 | 1½ |
| | 30 | 5 | 0 | 7 | 6¾ | 30 | 5 | 3 | 24 | 4 | 30 | 6 | 3 | 23 | 10 | 30 | 7 | 3 | 5 | 6¾ | 30 | 9 | 0 | 16 | 10¼ |
| | 40 | 6 | 3 | 0 | 9 | 40 | 7 | 3 | 23 | 0 | 40 | 9 | 1 | 3 | 8 | 40 | 10 | 1 | 16 | 9 | 40 | 12 | 0 | 22 | 2 |
| | 50 | 8 | 1 | 21 | 11¼ | 50 | 9 | 3 | 21 | 12 | 50 | 11 | 2 | 11 | 6 | 50 | 12 | 3 | 27 | 11¼ | 50 | 15 | 0 | 27 | 10¾ |
| | 60 | 10 | 0 | 14 | 13½ | 60 | 11 | 3 | 20 | 8 | 60 | 13 | 3 | 19 | 4 | 60 | 15 | 2 | 10 | 43½ | 60 | 18 | 1 | 5 | 3½ |
| Half coil ... | 66-4 | 11 | 1 | 1 | 0 | 66-4 | 13 | 1 | 1 | 0 | 66-4 | 15 | 1 | 24 | 8 | 66-4 | 17 | 1 | 9 | 0 | 66-4 | 20 | 1 | 9 | 0 |

| | 8¾-in. Rope. | | | | | 9½-in. Rope. | | | | | 10¼-in. Rope. | | | | | 11-in. Rope. | | | | | 11¾-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in fathoms. | Weight, c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. | Length in fathoms. | Weight. c. | qr. | lb. | oz. |
| | 70 | 11 | 3 | 7 | 15¾ | 70 | 13 | 3 | 19 | 4 | 70 | 16 | 0 | 27 | 2 | 70 | 18 | 0 | 21 | 15¾ | 70 | 21 | 1 | 10 | 12¼ |
| | 80 | 13 | 2 | 1 | 2 | 80 | 15 | 3 | 18 | 0 | 80 | 18 | 2 | 7 | 0 | 80 | 20 | 3 | 5 | 2 | 80 | 24 | 1 | 16 | 5 |
| | 90 | 15 | 0 | 22 | 4¼ | 90 | 17 | 3 | 16 | 12 | 90 | 20 | 3 | 14 | 14 | 90 | 23 | 1 | 16 | 4½ | 90 | 27 | 1 | 21 | 13¾ |
| | 100 | 16 | 3 | 15 | 6½ | 100 | 19 | 3 | 15 | 8 | 100 | 23 | 0 | 22 | 12 | 100 | 25 | 3 | 27 | 6¼ | 100 | 30 | 1 | 27 | 6½ |
| | 110 | 18 | 2 | 8 | 8¾ | 110 | 21 | 3 | 14 | 4 | 110 | 25 | 2 | 2 | 10 | 110 | 28 | 2 | 10 | 8¾ | 110 | 33 | 2 | 4 | 15¼ |
| | 120 | 20 | 1 | 1 | 11 | 120 | 23 | 3 | 13 | 0 | 120 | 27 | 3 | 10 | 8 | 120 | 31 | 0 | 21 | 11 | 120 | 36 | 2 | 10 | 8 |
| Whole coil. | 133-2 | 22 | 2 | 2 | 0 | 133-2 | 26 | 2 | 2 | 0 | 133-2 | 30 | 3 | 21 | 0 | 133-2 | 34 | 2 | 18 | 0 | 133-2 | 40 | 2 | 18 | 0 |

| | 9-in. Rope. | | | | | 9¾-in. Rope. | | | | | 10½-in. Rope. | | | | | 11¼-in. Rope. | | | | | 12-in. Rope. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0 | 0 | 19 | 10 | 1 | 0 | 0 | 23 | 14 | 1 | 0 | 0 | 27 | 3½ | 1 | 0 | 1 | 3 | 4¾ | 1 | 0 | 1 | 7 | 10¼ |
| | 5 | 0 | 3 | 14 | 2 | 5 | 1 | 0 | 7 | 6¼ | 5 | 1 | 0 | 24 | 2 | 5 | 1 | 1 | 16 | 8¼ | 5 | 1 | 2 | 10 | 3 |
| | 10 | 1 | 3 | 0 | 4½ | 10 | 2 | 0 | 14 | 12¾ | 10 | 2 | 1 | 20 | 4 | 10 | 2 | 3 | 5 | 0¾ | 10 | 3 | 0 | 20 | 6 |
| | 20 | 3 | 2 | 0 | 8¾ | 20 | 4 | 1 | 1 | 9½ | 20 | 4 | 3 | 12 | 8 | 20 | 5 | 2 | 10 | 1½ | 20 | 6 | 1 | 12 | 12 |
| | 30 | 5 | 1 | 0 | 12¾ | 30 | 6 | 1 | 16 | 6¼ | 30 | 7 | 1 | 4 | 12 | 30 | 8 | 1 | 15 | 1¼ | 30 | 9 | 2 | 5 | 2 |
| | 40 | 7 | 0 | 1 | 1 | 40 | 8 | 2 | 3 | 3 | 40 | 9 | 2 | 25 | 0 | 40 | 11 | 0 | 20 | 2 | 40 | 12 | 2 | 25 | 8 |
| | 50 | 8 | 3 | 1 | 5¼ | 50 | 10 | 2 | 17 | 15¾ | 50 | 12 | 0 | 17 | 4 | 50 | 13 | 3 | 25 | 2¾ | 50 | 15 | 3 | 17 | 4 |
| | 60 | 10 | 2 | 1 | 9½ | 60 | 12 | 3 | 4 | 12½ | 60 | 14 | 2 | 9 | 8 | 60 | 16 | 3 | 2 | 3½ | 60 | 19 | 0 | 10 | 4 |
| Half coil ... | 66-4 | 11 | 2 | 20 | 8 | 66-4 | 14 | 0 | 24 | 0 | 66-4 | 16 | 0 | 23 | 0 | 66-4 | 18 | 2 | 15 | 0 | 66-4 | 21 | 0 | 24 | 0 |
| | 70 | 12 | 1 | 1 | 13¾ | 70 | 16 | 3 | 19 | 9¼ | 70 | 17 | 0 | 1 | 12 | 70 | 19 | 2 | 7 | 4½ | 70 | 22 | 1 | 2 | 10 |
| | 80 | 14 | 0 | 2 | 2 | 80 | 17 | 0 | 6 | 6 | 80 | 19 | 1 | 22 | 0 | 80 | 22 | 1 | 12 | 5 | 80 | 25 | 1 | 23 | 0 |
| | 90 | 15 | 3 | 2 | 6½ | 90 | 19 | 0 | 21 | 2¾ | 90 | 21 | 3 | 14 | 4 | 90 | 25 | 0 | 17 | 5¾ | 90 | 28 | 2 | 15 | 6 |
| | 100 | 17 | 2 | 2 | 10½ | 100 | 21 | 1 | 7 | 15½ | 100 | 24 | 1 | 6 | 8 | 100 | 27 | 3 | 22 | 6½ | 100 | 31 | 3 | 7 | 12 |
| | 110 | 19 | 1 | 2 | 14¾ | 110 | 23 | 1 | 22 | 12¼ | 110 | 26 | 2 | 26 | 12 | 110 | 30 | 2 | 27 | 7¼ | 110 | 35 | 0 | 0 | 2 |
| | 120 | 21 | 0 | 3 | 3 | 120 | 25 | 2 | 9 | 9 | 120 | 29 | 0 | 19 | 0 | 120 | 33 | 2 | 4 | 8 | 120 | 38 | 0 | 20 | 8 |
| Whole coil. | 133-2 | 23 | 1 | 13 | 0 | 133-2 | 28 | 1 | 20 | 0 | 133-2 | 32 | 1 | 18 | 0 | 133-2 | 37 | 1 | 2 | 0 | 133-2 | 42 | 1 | 20 | 0 |

The foregoing Tables will be found useful in ascertaining the weight of rope on board, and also in checking the rope-makers' bill.

"Spun yarn" is manufactured out of the short fibres or toppings of hemp; it is usually laid in from two to six yarns, not much hardened in the lay; it takes a considerable quantity of tar, and its principal use is to serve over rigging at those parts where the most wear is, to prevent the rope cutting or chafing, as it is much easier to replace the service of spun yarn, when chafed or worn, than to fit a new rope.

For the information of such yachtsmen as may contemplate a cruise in the whaling latitudes, I detail some information relative to whale lines.

Whale lines are spun out of the very best hemp that can be had in the market; it should be prepared by a most experienced hemp dresser; there is no fixed size for whale lines; some whaling masters prefer one size, some another, but the size principally approved of is a line 2½ inches in circumference.

A coil of 2½-inch whale line will weigh 1cwt. 3qrs. 20lbs., and will measure 133 fathoms, 2 feet.

Fore-gangers are made of yarns spun much finer than for the whale lines; they are made into white rope, and are seized to the harpoon, and then spliced to the whale line. They are generally 2¾ inches in circumference.

A coil of fore-ganger line 2¾ inches will weigh 1cwt. 3qrs. 20lbs., and will measure 133 fathoms 2 feet. They alone are used in the North or Greenland Fishery.

In the Southern Whale Fishery the lines used are much smaller, there not being any ice to contend with, they are not therefore required of such strength, and they are used without any white line for fore-ganger. The usual size is tarred line of 2 inches in circumference, equally carefully spun, and laid as the Greenland lines. A coil of 2-inch South Sea whale line will weigh 1cwt. 0qr. 20lbs., and will measure 133 fathoms 2 feet.

In an old work on cordage it is stated that the trial cordage delivered into Royal Dockyards is submitted to, is as follows:—"One strand is selected out of each rope, and every thread (or yarn), comprising the said strand, is tested by a weight of one-third of a cwt. being tied to it, which it should lift; if a certain number of yarns break in the trial, the rope is of course rejected."

I here subjoin a Table of the squares of the dimensions of all sizes of cordage, from three-quarters to twenty-four inches in circumference.

| Sizes in Inches. | Square. | Size in Inches. | Square. |
|---|---|---|---|
| ¾ | ·5625 | 9½ | 90·25 |
| 1 | 1· | 9¾ | 95·0625 |
| 1¼ | 1.5625 | 10 | 100· |
| 1½ | 2·25 | 10¼ | 105·0625 |
| 1¾ | 3·0625 | 10½ | 110·25 |
| 2 | 4· | 10¾ | 115·5625 |
| 2¼ | 5·0625 | 11 | 121· |
| 2½ | 6·25 | 11¼ | 126·5625 |
| 2¾ | 7·5625 | 11½ | 132·25 |
| 3 | 9· | 11¾ | 138·0625 |
| 3¼ | 10·5625 | 12 | 144· |
| 3½ | 12·25 | 12½ | 156·25 |
| 3¾ | 14·0625 | 13 | 169· |
| 4 | 16· | 13½ | 182·25 |
| 4¼ | 18·0625 | 14 | 196· |
| 4½ | 20·25 | 14½ | 210·25 |
| 4¾ | 22·5625 | 15 | 225· |
| 5 | 25· | 15½ | 240·25 |
| 5¼ | 27·5625 | 16 | 256· |
| 5½ | 30·25 | 16½ | 272·25 |
| 5¾ | 33.0625 | 17 | 289· |
| 6 | 36· | 17½ | 306·25 |
| 6¼ | 39·0625 | 18 | 324· |
| 6½ | 42·25 | 18½ | 342·25 |
| 6¾ | 45·5625 | 19 | 361· |
| 7 | 49. | 19½ | 380·25 |
| 7¼ | 52·5625 | 20 | 400· |
| 7½ | 56·25 | 20½ | 420·25 |
| 7¾ | 60·0625 | 21 | 441· |
| 8 | 64· | 21½ | 462·25 |
| 8¼ | 68·0625 | 22 | 484. |
| 8½ | 72·25 | 22½ | 506·25 |
| 8¾ | 76·5625 | 23 | 529· |
| 9 | 81· | 23½ | 552·25 |
| 9¼ | 85·5625 | 24 | 576· |

In cordage made above the circumference of twelve inches, it is not usual to reckon quarter inches in the sizes worked.

All cables and cordage should be tarred with the best Stockholm tar.

I subjoin a table of the Weights of cordage, hawsers, cablets, and cables, according to the rule of the Government Yards.

Cordage Line—Coils of 130 Fathoms. Hawsers of 130 Fathoms.

| Inches in Circumference. | Weight. | | | Inches in Circumference. | Weight. | | |
|---|---|---|---|---|---|---|---|
| | cwt. | qrs. | lbs. | | cwt. | qrs. | lbs. |
| ¾ | 0 | 1 | 4 | 4 | 5 | 0 | 14 |
| 1 | 0 | 1 | 20 | 4½ | 6 | 1 | 22 |
| 1½ | 0 | 3 | 18 | 5 | 7 | 3 | 19 |
| 2 | 1 | 1 | 6 | 5½ | 9 | 2 | 2 |
| 2½ | 2 | 0 | 5 | 6 | 11 | 1 | 3 |
| 3 | 2 | 3 | 20 | 6½ | 13 | 1 | 11 |
| 3½ | 3 | 3 | 7 | | | | |

| Cablets of 120 Fathoms. | | | | Cables of 100 Fathoms. | | | |
|---|---|---|---|---|---|---|---|
| Inches in Circumference. | Weight. | | | Inches in Circumference. | Weight. | | |
| | cwt. | qrs. | lbs. | | cwt. | qrs. | lbs. |
| 2 | 1 | 1 | 4 | 10 | 21 | 0 | 23 |
| 2½ | 1 | 3 | 0 | 10½ | 23 | 1 | 17 |
| 3 | 2 | 2 | 11 | 11 | 25 | 5 | 10 |
| 3½ | 3 | 1 | 22 | 11½ | 27 | 3 | 4 |
| 4 | 4 | 0 | 18 | 12 | 30 | 1 | 10 |
| 4½ | 5 | 0 | 23 | 12½ | 32 | 3 | 17 |
| 5 | 6 | 2 | 1 | 13 | 35 | 3 | 9 |
| 5½ | 7 | 3 | 7 | 13½ | 38 | 3 | 1 |
| 6 | 9 | 0 | 12 | 14 | 41 | 2 | 20 |
| 6½ | 10 | 1 | 19 | | | | |
| 7 | 12 | 0 | 18 | | | | |
| 7½ | 13 | 3 | 16 | | | | |
| 8 | 16 | 3 | 6 | | | | |
| 8½ | 18 | 3 | 27 | | | | |
| 9 | 20 | 1 | 17 | | | | |
| 9½ | 22 | 2 | 9 | | | | |

An excellent rule to calculate very nearly the weight of any size rope, from 8 to 24 inches in circumference, 120 fathoms in length, or lesser lengths in proportion, is as follows :—

Multiply the circumference of the rope by the circumference ...
fourth of that product ...

EXAMPLE.—Suppose ...
100: the fourth of whic ...
of rope, 10 inches in cir ...

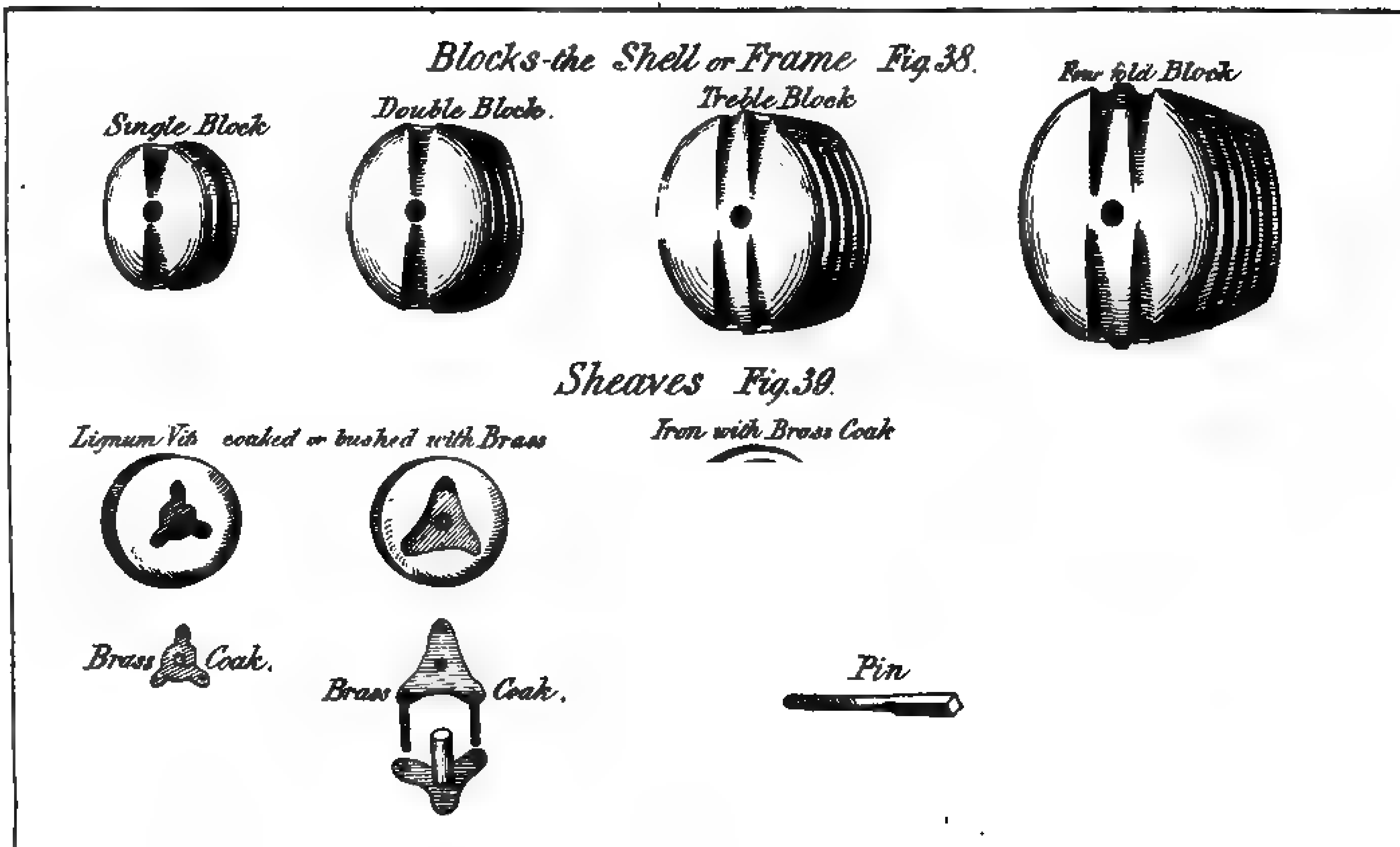
The prices of cordage varies according to the price of hemp in the market.

There is some very beautiful cotton rope manufactured now, but I cannot speak of its durability, not having had much experience with it; it is particularly suited for yachts' use, from its neatness of finish and elegant appearance. I have seen it used for main-sheets, runner tackles, ridge ropes, man-rope, tiller ropes, and yoke ropes. It cleans up very brilliantly with pipe-clay or whiting.

A very important branch of a yacht's rigging is comprised under the heads of Blocks, Purchases, Tackles, &c.

The principal blocks in general use are—the single block of one sheave; the double block of two sheaves; the treble block of three sheaves; and the four-fold block of four sheaves; from these they range up to eight sheaves.

The woods used in the making of yachts' blocks are for the shells ash, elm, or sycamore. The sheaves of blocks are of lignumvitæ, iron,


Blocks-the Shell or Frame Fig. 38.
Single Block
Double Block.
Treble Block
Four fold Block
Sheaves Fig. 39.
Lignum Vit. coaked or bushed with Brass
Iron with Brass Coak
Brass Coak.
Brass Coak.
Pin

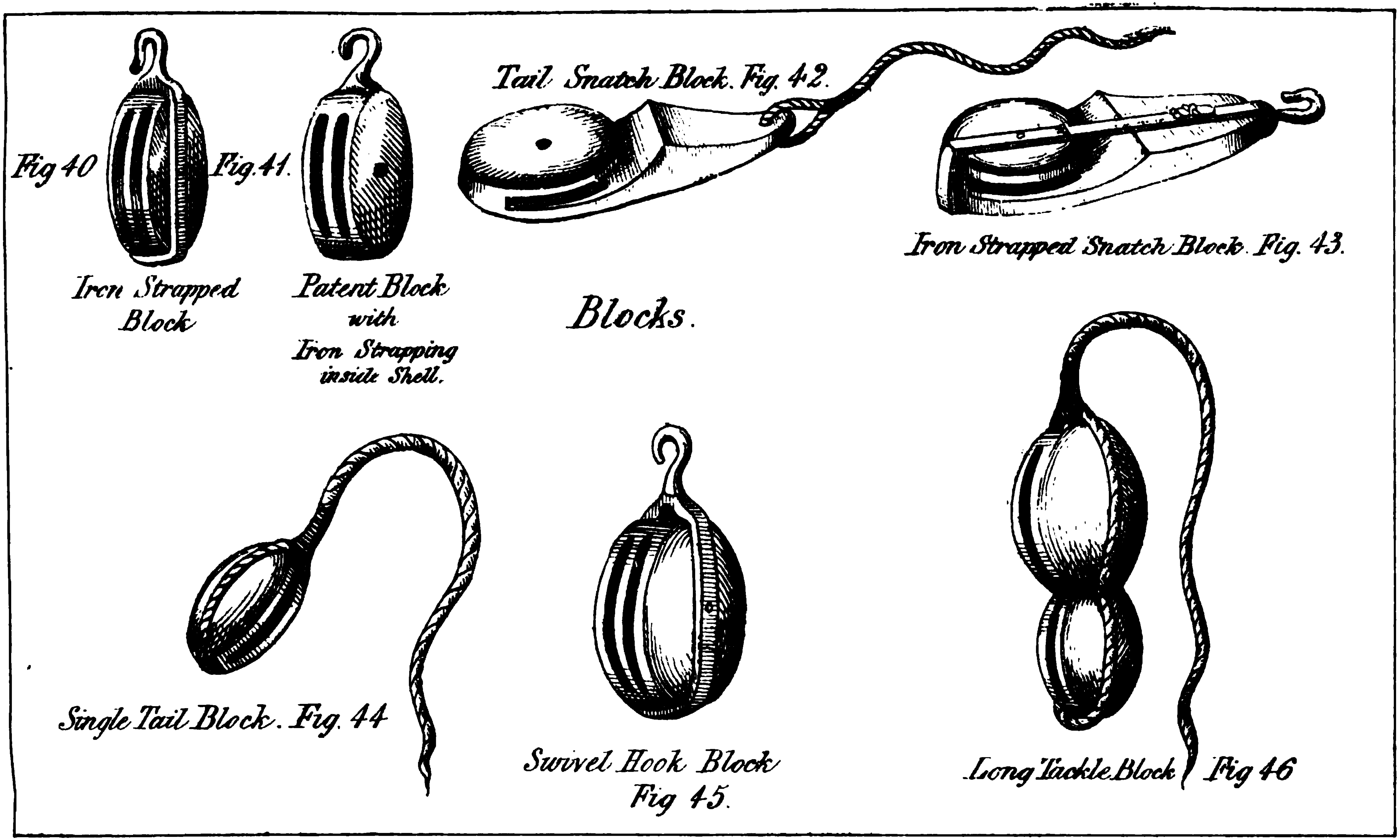
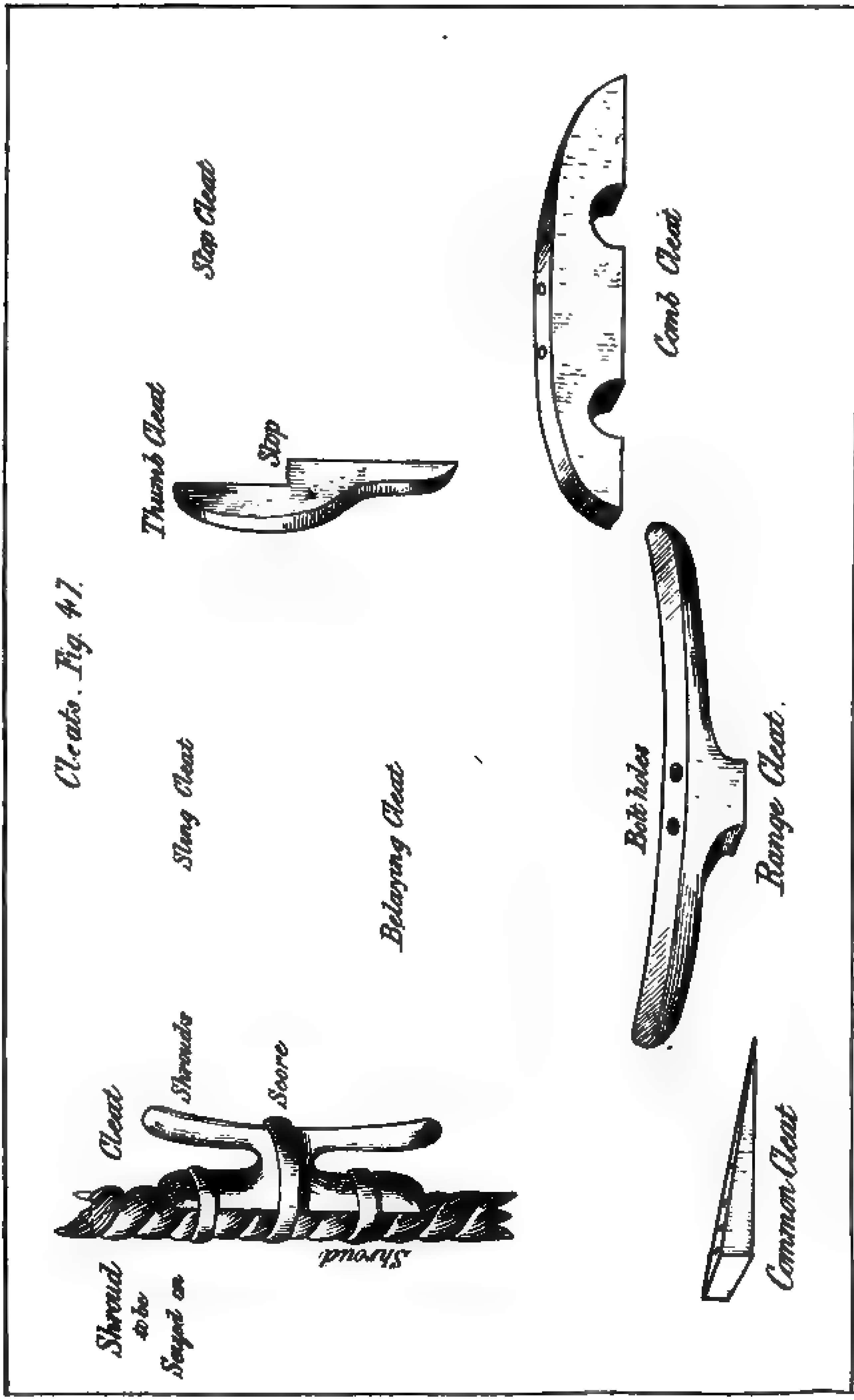


Fig 40
Iron Strapped Block
Fig. 41.
Patent Block with Iron Strapping inside Shell.
Tail Snatch Block. Fig. 42.
Iron Strapped Snatch Block. Fig. 43.
Blocks.
Single Tail Block. Fig. 44
Swivel Hook Block Fig 45.
Long Tackle Block Fig 46




Cleats. Fig. 47.

Plate 14.

Fig. 48

Selvagee Strap marled & ready for Use.

Fig 49.

Improved Selvagee Strap Board.

or brass. The pins of blocks are made of lignumvitæ, green heart, or iron. The component parts of a block are (Fig. 38, Plate 11,) the shell or frame, and Fig. 39 the sheaves.

It is the practice now on board yachts to have as many blocks as possible iron strapped as Fig. 40. There is a patent block lately invented, in which the iron strapping goes inside, and the shell of the block is neatly rivetted over it, as Fig. 41. It makes an exceedingly neat and strong block. When chain jib hilliards are used, there should be patent iron blocks used, as the chain very soon knocks the wooden blocks to pieces.

No yacht should ever be without several snatch blocks; to a racing yacht they are indispensable, There are two descriptions, the tail snatch block, as Fig. 42, which can be made fast at any place, either to rigging or spars, where a pull may be required.

And the iron strapped snatch blocks as Fig. 43, with a swivel hook at the end, for hooking on to eye or ring bolts, beckets, &c., where an extra purchase may be required, or a fall led fair for the crew to get a good pull together at.

A plain single block, as Fig. 44, with a tail is also exceedingly useful for good pull here and there.

All tackle and purchase blocks should have at least one swivel, that is, the hook should play in the iron strap, as Fig. 45, as if not the running parts will get jammed, and perhaps at the most critical moment when you require to get a strong pull with your purchase or tackle, in order to set everything up as taut as a bar, you may find them so twisted, that unless you burst everything you cannot get down a single inch.

Long tackle blocks are two single blocks made in the solid; they are used for tackles, and make the neatest and best blocks for the runner tackle, see Fig. 46, Plate 12.

"The proportions for single, double, treble, four-fold, and other blocks, are as follows:"—

The "length" is "eight" times the "breadth" of the "sheave-hole," which is "one-sixteenth" of an inch more than the thickness of the sheave; the thickness of the sheave is "one-tenth" more than the "diameter" of the "rope" it is intended for, and the "diameter" of the "sheave" is "five" times the thickness. The breadth of the block to be "six" times the "thickness" of the "sheave," and the

thickness to be one half the length, or nearly so. Blocks to be strapped with iron should have the strap fitted before the sheave hole is cut out. Iron straps for blocks vary from a quarter of an inch to an inch in thickness, and nearly three times the thickness in breadth. Cleats (Fig. 47) are of various shapes and uses, those delineated in Plate 13 are the principal.

In rope strapped blocks the following dimensions of straps are according to established usage.

## TABLE I.

| Size of the Blocks. | Circumference of the Straps. | Length of the Straps. | | Size of the Blocks. | Circumference of the Straps. | Length of the Straps. | |
|---|---|---|---|---|---|---|---|
| Inches. | Inches. | ft. | in. | Inches. | Inches. | ft. | in. |
| 4 | 0¾ | 1 | 6 | 11 | 3 | 4 | 2 |
| 5 | 1½ | 1 | 9 | 12 | 3¼ | 4 | 6 |
| 6 | 2 | 2 | 6 | 13 | 3⅜ | 4 | 11 |
| 7 | 2¼ | 2 | 9 | 14 | 3½ | 5 | 4 |
| 8 | 2⅜ | 3 | 0 | 15 | 4 | 6 | 0 |
| 9 | 2½ | 3 | 4 | 16 | 4½ | 6 | 8 |
| 10 | 3 | 3 | 9 | 17 | 5 | 7 | 4 |

## TABLE II.

| Size of the Blocks. | Size of the Straps. | Length when spliced for Single Blocks. | | Length of seizing for Single Blocks. | | Length when spliced for Double Blocks. | | Seizing for Double Blocks. | |
|---|---|---|---|---|---|---|---|---|---|
| Inches. | In. in Circum. | ft. | in. | Marline in ft. | | ft. | in. | Marline in ft. | |
| 5 | 1½ | 1 | 5 | 6 | | 1 | 7 | 6 | |
| 6 | 2 | 1 | 6 | 6 | | 1 | 9 | 6 | |
| 7 | 2 | 1 | 9 | 7 | | 2 | 0 | 7 | |
| 8 | 2½ | 2 | 0 | 9 | | 2 | 3 | 10 | |
| 9 | 3 | 2 | 3 | 11 | | 3 | 0 | 13 | |
| 10 | 3 | 3 | 0 | 13 | | 3 | 3 | 15 | |
| | | | | Rope. | | | | Rope. | |
| | | | | Size in inches | Length in fathms | | | Size in inches. | Length in fathoms. |
| 11 | 3½ | 3 | 3 | ½ | 2½ | 3 | 6 | ½ | 3 |
| 12 | 4 | 3 | 6 | ¾ | 3 | 3 | 9 | ¾ | 3½ |
| 13 | 4 | 3 | 9 | ¾ | 3½ | 4 | 3 | ¾ | 3½ |
| 14 | 4½ | 4 | 2 | 1 | 3½ | 4 | 6 | 1 | 3½ |
| 15 | 5 | 4 | 5 | 1¼ | 3½ | 4 | 9 | 1¼ | 4 |
| 16 | 5½ | 4 | 8 | 1¼ | 4 | 5 | 1 | 1¼ | 4 |
| 17 | 6 | 5 | 1 | 1⅜ | 4 | 5 | 7 | 1½ | 4 |
| 18 | 6½ | 5 | 7 | 1⅜ | 4 | 6 | 2 | 1⅝ | 4 |
| 19 | 7 | 6 | 1 | 1½ | 4 | 6 | 9 | 1¾ | 4 |
| 20 | 7½ | 6 | 9 | 2 | 3½ | 7 | 4 | 2 | 3½ |

In cutting straps from three inch rope and upwards, eighteen inches

*Plate 15.*

more length will be required for splicing, &c. Under three inch, twelve to fifteen inches will be required.

In yachts, it is now the prevailing practice with many blocks that are rope strapped, to strap them with selvagee straps, which are thus made:—two pegs, or large iron spikes, or pins, are driven into a piece of board, at such distances apart as the length of the strap is intended to be, the end of a ball of rope yarn is made fast to one of the pegs or pins and passed round the other; the rope yarn is then passed round and round the pins, hauling every turn taut, until it is as stout as the circumference of the strap is intended to be; it is then marled over, and the strap is complete. When it is to be a large strap, it should be marled over with stout spun yarn; if a middle sized strap, with two single rope yarns; and if a small strap, with a single rope yarn. Fig. 48, Plate 14 will give some idea of the manner in which it is made, and the appearance of the selvagee straps when finished, Fig. 49.

An improved selvagee strap board (Fig. 50 Plate 14,) may be constructed according to the annexed sketch, and by it when the rope yarns are wound round the pins to the size of the straps required, they may be stretched, so as to ensure a well fitting strap. By means of this board (Fig. 50) any size strap may be made, hove to its full stretch by means of the screw, marled on the stretch, and will fit the block neatly without becoming slack when the working strain is on it.

Selvagee straps are usually covered with canvas, or brown leather, the leather should be well soaked in water, and sewn on whilst wet, it will shrink as it dries and make a very neat cover; it may then be varnished with the block. Selvagee straps make by far the neatest, and as far as my experience goes, as strong as any strap, except iron. The lower dead eyes of the main shrouds, are always iron bound, and are hooked on to the chain plates, which are let in flush with the top sides; a word or two on this subject may serve to call the attention of yachtsmen to the mode in which the chain plates are very often bolted on the top sides, and through the top timbers. This matter should be more carefully looked to than it is; as the greatest strain of masts, sails, and rigging, come upon the chain plates, and consequently their fastenings should be particularly attended to. I shall endeavour to elucidate my meaning by Fig. 51, Plate 15. Here we have the skeleton of a yacht's topside, showing A the channel, B B B, the chain plates, C C C the top timbers to which, and through the external planking, they are bolted:

now it is quite evident that an enormous strain comes upon the heads of these three top timbers, divided, it is true, between them, the external planking, and the internal stringer; but not sufficient to my mind is the resistance to that strain; and I am led to think that leaky top sides and leaky and rotten covering boards, may be very often attributed to the working of these parts, consequent upon this great strain. I would suggest to yachtsmen when building, to have a solid plate of wrought iron (or it may be made in lengths and rivetted together) as D, fitted to the inside of each timber, through which a chain plate is bolted, thence down along the futtock and floor timbers, across the keelson as at E, and so up the opposite frame to the opposite chain plate; to meet the tranverse strain I would have a lining plate of iron let into the underneath part of the deck beam, the ends to meet the chain plate bolts as at F, this would make a solid fine job. In yachts now afloat, and not any way strengthened to meet the strain of the chain plates, I would suggest the cross plating, strong flat iron plates, as marked by the dotted lines G.

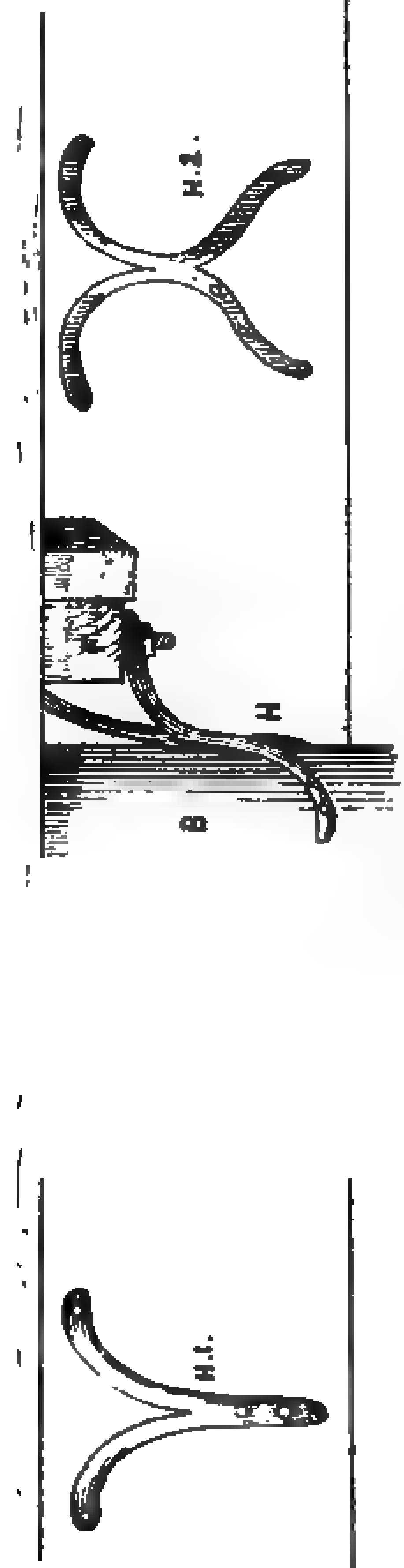
I have often been astonished at the weak manner in which some yachts are put together; however, "what the eyo don't see the heart don't grieve at," and a neatly made up cabin covers a multitude of short comings; it is a great blessing that some men do stay in harbour during rough weather, and at night time.

Another portion of the fittings connected with the main rigging, is the runner and tackle chain plates; in very many yachts of this day they are fitted according to Fig. 52 and 53.

The direction of the strain of the runner tackle is indicated by the arrow A, it is at a considerable angle with the runner plate; the mechanical yachtsman will perceive the disadvantage of this. The bulwark stanchion should be placed to the angle of the runner tackle as at B, and the runner plate will then tend fairly to the strain of the pendant. It should be made of a piece of the best oak, with self-grained angle. The dotted lines represent the bulwark sheeting. The tendency of the vertical stanchion is to come inboard when hard pressed, and very often if you look along the rail of a cutter, either a racing or a cruising vessel, you will observe the rail set forcibly in from the effects of the double strain; in yachts with the angular stanchion it is not so frequently observable in fact very seldom.

One of the most essential points in regard to the strength of a yacht

Plate 16.



and her security in a seaway, is the manner in which the strain of the main and peak halliards, and the fore and gaff topsails halliards, belayed upon the mast bitts and pin rack, is guarded against; more particularly in large vessels; but unless the yachtsman makes it his study even in a tiny ten ton craft, to have everything right and ship-shape, he will never arrive at the knowledge of all that is required to be known in his favorite pursuit.

The mast bitts are tenoned into the mast beams or partners through the deck, eye bolts for main tack tackle and gaff topsail tack purchase, and sundry other purposes are also bolted through these beams and partners, and although very little importance is attached to this particular point by yachtsmen, it is nevertheless deserving of attentive consideration. I must again have recourse to my pencil, in order to convey my meaning, in however rough a manner (see Fig. 54, plate 16): A represents the deck, B B the mast, above and below the deck; C C the mast bitts, which are not often double, but only single mast bitts, as at ●: sometimes there is a second pair abaft the mast as at ⊙, and sometimes there are only a single pair, either before or abaft the mast. D. D. are the eye bolts for hooking the main tack tackle to, as also the gaff topsail tack purchase, and sundry other purposes.

It must be evident that the tendency of the strain of all these ropes is to lift the deck up, beams, partners, and all; and sometimes you will hear complaints of how it is impossible to keep the wedging of the mast at E tight, and how it works, and the bitts are shaky, and all that sort of thing.

Now there is a very simple, strong, and effective plan by means of a preventer plate, which all properly found yachts are fitted with, and which no vessel should be without. F F F represents the underneath part of the deck, with the beams, partners, &c.; H 1 & H 2 are preventer plates, of different shapes, according to fancy: H 2 is the best. H H shows the mode of application, they are spiked to the mast, and the bolt eyes take the ends of the eye bolts D D, through the beams, so that should the deck lift it must take the mast along with it, which would be impossible. These plates make a strong and never-failing binding between the mast, beams, partners, and bitts, and as I before said no vessel should be without them.

Now as every yachtsman should know the little odds and ends of purchases, tackles, knots and splices; and the thousand and one

matters that may stand him in need during his cruises, I will enumerate some of them here, with illustrations as we go on.

Worming, parcelling, and serving a rope, are terms which are often heard on board, and the manner in which it is performed is as follows :—

You get your rope upon a stretch, making one end fast to the bitts, or any convenient place, and getting your reef tackle with the standing block hooked to an eye bolt in the deck, or a strap round a timber head, and the running block hooked on to the other part of the rope, by means of a selvagee strap, then bowse* well upon the tackle until everything is as taut as a bar; your rope is then ready for operating upon, and the *modus operandi* will, I trust, be understood by reference to Fig. 55, Plate 17.

Worming is performed with a ball of spun yarn, laid tightly into the divisions between the strands, so as to fill up the inequalities, and present a smooth surface for the parcelling and serving. (See No. 1, Fig. 55.)

Parcelling is performed by laying narrow strips of canvas round the rope "with the lay," or the direction of the strands; these pieces of canvas should be well tarred, in order to guard against water lodging in the service, and rotting the rope underneath (See No. 2, Fig. 55.)

Serving the rope is the last operation, and is done on small ropes with a serving board, and on large ropes with a serving mallet (see sketch), it is performed by winding spun yarn round the rope, over the parcelling and worming, small ropes may be served without worming or parcelling, but never large ropes; serving is laid on "against" the lay, or trend of the strands, in contradistinction to the worming and parcelling which are put on "with" the lay or trend of the rope. (See No. 3, Fig. 55.)

Worming, parcelling, and serving, are performed on all parts of ropes liable to be chafed; such as the eyes of the rigging, forestay, pendants, reef pendants, &c.

Every yachtsman should know how to splice a rope, and I therefore give sketches and descriptions of the most useful splices; let the yachtsman remember that plenty of grease is a great persuader to the obstinacy of ropes, and if he wants to make himself properly acquainted with the mysteries of his pastime, he is hereby further informed, that neither grease nor tar, in moderation, destroy the

* Namely, take a regular good pull.

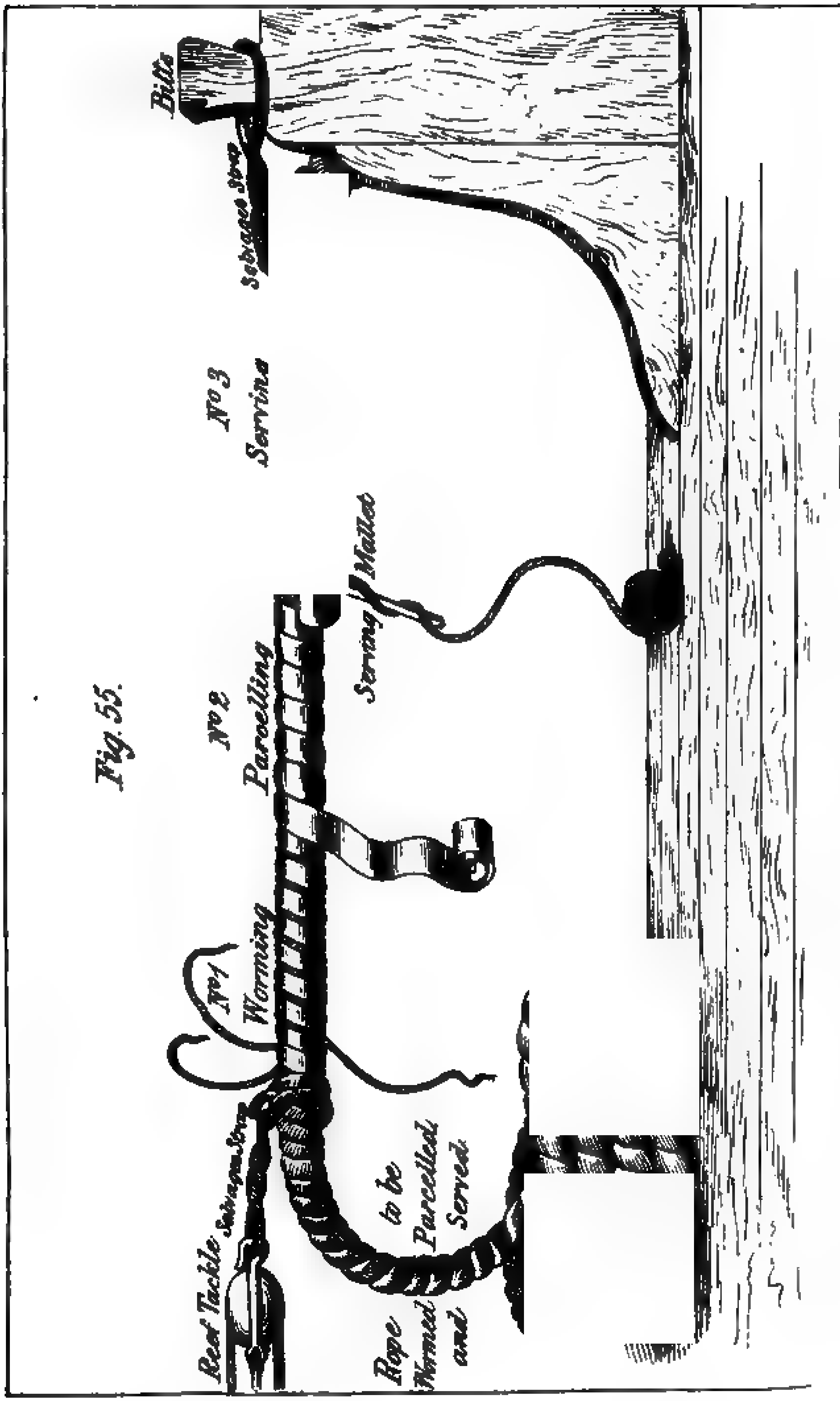


Fig. 55.
No 1 Worming
No 2 Parcelling
No 3 Serving
Bitts
Selvagee Strop
Serving Mallet
Reef Tackle Selvagee Strop
Rope to be
Wormed Parcelled
and Served

Fig. 59.

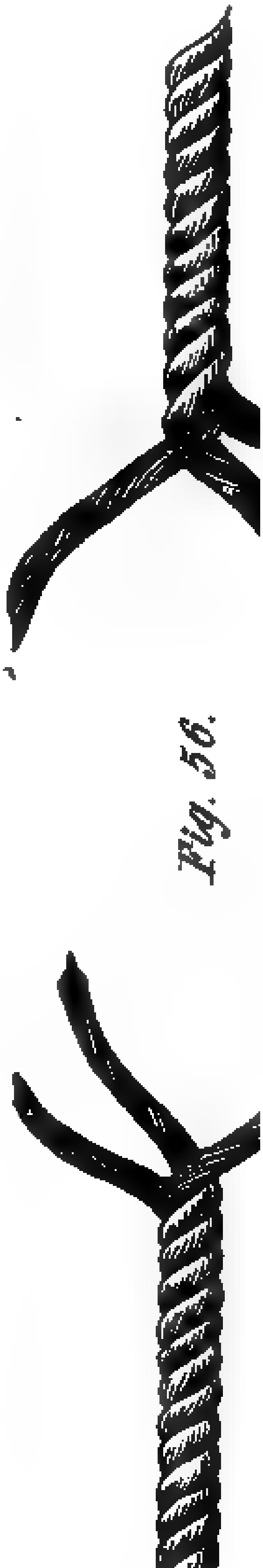


Fig. 56.

Fig. 58

*Plate 19.*

appearance of the hands, or the delicate formation of the nails; one trial will suffice, but half-a-dozen will ensure safety, so that no nervous delicacy as to personal injury need agitate his mind; what he loses in one way, he will gain in a far more essential, viz., health, strength, and manliness.

The first lesson a yachtsman should learn is to join the ropes together, sailor fashion; the first method of doing so is by means of a "short splice," performed thus:—

Unlay the ends of the rope you propose to join (Fig. 56, Plate 18), place them together, as Fig. 57; grease the ends of the strands well, and taper them with the lay, as hard as you can twist them up, so that they may pass easily through the opened strands, during the process of splicing; then take your marlinspike (Figs. 58 or 59), grease it, and open strand (No. 1, Fig. 60), through which shove strand A of the other end, and so on raising the alternate strands, on both ends, and working in the strands that have been unlaid; your splice then presents the appearance, after the opposite ends are "once" passed through the strands (see Fig. 61.) After the strands are stuck, or passed once, you may unlay them, cut one half of the yarns off, and pass the remainder again, always taking care that it is the upper half you pass, this will make your splice appear neatly tapered off.

The long splice (Fig. 62, Plate 19), comes next; it is most useful to know, in case of carrying away any of your running gear, as a long spliced rope will reeve and run through any block, just the same as a new rope, and comparatively as strong. It is made thus, unlay the ends of the ropes four or six times as long as you would for a short splice, or in round numbers, say from three to six feet; then unlay one strand in each end for half the same length additional, place the middle strands together as at A in the sketch, then the additionally unlaid strands will appear as at B and C, and the score or interval left by them will appear in the darkened lines as D D, E E. Take off the centre strands F and G, and lay them into the vacant scores D D, E E, until they meet B and C at 1 and 2; then take of the centre strands H and J, divide the yarns each in half as represented in the sketch, take an overhand knot with them (Fig. 68), and stick the ends, as in a short splice; perform the same operation exactly with the additionally unlaid strands B and C, and F and G laid up to them,

dividing, knotting, and sticking the half strands in the same manner; now get your rope on a good stretch, the same as if you were going to serve it, heave it well taut, and see that your splice is well stretched, and the knotted half strands well berthed in their scores, then cut all ends off neatly, but not too closely, and your long splice is complete.

An eye splice (Fig. 64) is useful to splice a rope round a block, dead eye, traveller, or thimble, it is very simple, and performed by unlaying the end of the rope, laying it back over the standing part, and sticking in the strands just as you would in a short splice.

An artificial eye (Fig. 65) is made in somewhat a similar manner as a long splice; you unlay one strand of the end of a rope somewhat more than the size of the eye you design to make, then lay the two laid strands back to the standing part of the rope at No. 1, pass the unlaid strand across as at A, and lay it up again in its former score B B B all round the eye, until it comes down under the two laid strands into its old berth, then stick the three strands as in the previous eye splice, or halve the yarns, taper them down, marl and serve them over.

A cut splice (Fig. 66) is useful to form an eye in the middle of a rope, and in small yachts does for the eye of the topmast shrouds; it is made by placing the unlaid ends of each rope on the standing part of the other, and sticking the ends in the opposite strands just the same as in a short splice.

Sometimes a single strand of a rope may be cut or chafed, and the other strands remain perfectly good; it is an unsightly thing to see wounded rope of this description, and therefore a useful way of repairing the damage is putting a new strand in, which is done by cutting out the chafed strand for some two or three feet on each side of the injury, and then taking the strand of another rope of the same size, lay it into the score where lay the damaged one before, lay it up just the same as in a long splice, halve, stick, and cut the half strands, and the repair is complete. See Fig. 67, Plate 20, as to appearance of the rope and strand prepared.

A grommet (Fig. 68) is a useful ring of rope, and very simply made; take the strand of a rope sufficiently long for the sized grommet you design to make; then lay one end on the standing part to the size required, and with the other end fill in the scores all round until you

Plate, 20.

have a perfect ring of three strand parts, you finish the ends by dividing, over-hand knotting, and sticking them through the stands.

Grommets may be made out of the strands of old rope, they are useful in case the eyes of your topmast rigging stretch, and have a tendency to slip over the shoulder, or stop of the topmast; and that you may not have time to take down your topmast rigging to overhaul the eyes; then lower your topmast until the stop is nearly level with the mainmast head; lift the topmast rigging, put a grommet on the stop, lay your rigging over again, sway away on your heel rope, fid the topmast, set up your topmast rigging, and you are all ready for action.

Grommets are also useful for confining the heels of sprits to the mast of small boats, such as a yachts' cutter rigged with spritsails; in this position, it is called "snotter" (Fig. 69), and is cleated on the mast of the boat at the proper height.

Grommets are also used to confine the oars of a boat, when only a single thole pin is used; they are useful thus, as you may throw your oars from your hands, they will lie securely alongside; and should you carry away a thole pin, and another not be at hand, with a small piece of rope, a grommet is soon provided.

A sheep-shank (Fig. 70) is a method of shortening your topmast shrouds when your topmast is housed in bad weather.

However, as wire rope is gradually superseding hemp for topmast rigging, shrouds made of wire have thimbles spliced in them about midway to the cross-trees, then there are short pieces of shroud with galvanized clip hooks, the length that the topmast will house; and instead of the old sheep-shank being taken in the shroud, the short pieces are unhooked when the topmast is housed, put away securely below, the shroud tackles are hooked on the thimbles and the rigging set up as before, much neater and more securely; hemp shrouds may be fitted in the same way, for at best a sheep-shank, although secure, is clumsy and not yachtsman fashion.

Should you burst one of your main shrouds it is useful to know how to repair it; the neatest method of performing this operation is by means of a shroud knot (Figs. 71, 72, and 73, Plate 21).

Unlay the ends of the broken shroud the same as for a short splice, place them together closely as at A, make a loop of strand B, and pass the end of strand C through the bight of B as at D, then make a loop of strand E, and pass the end of strand B through it as at E, then pass the

end of strand E through the bight of strand C, and one side is done, taking care that all the ends are passed up through the loops or bights; do the same with the three strands upon the opposite side, and then draw all ends as taut as a bar, when the knot will present the appearance as at Fig. 72, taper down the ends of the strands on each side, marl and serve them over, and when finished, your shroud knot will present the appearance of Fig. 73.

Of purchases and tackles there are several, with which every yachtsman should make himself well acquainted. First, we have a single whip (Fig. 74, Plate 22). This is the most simple purchase, by means of it you may get up sails from the sail-room, water casks or fuel from the boat alongside, set your awning or wind sail, and a thousand and one little odds and ends on board, too numerous for detail here.

NOTE.—If there is a weight of 5lbs. at A, it will require 5lbs. at B to balance it, and the block C will have to bear a strain of 10lbs., and also the power applied at B to lift A.

A whip upon whip purchase (Fig. 75) is where the fall A of a single whip purchase is spliced, like the strap round the block of another whip purchase, as B.

NOTE.—If the hook No. 1 is attached to a weight of 10lbs., there will be a strain of 5lbs. at No. 2, and of 20lbs. at the upper block, No. 3.

A single Burton purchase (Fig. 76). This is one of the most useful purchases on board a yacht, by it the anchor is generally fished, the water and coke got on board, and sundry other jobs performed which require a handy and powerful purchase.

NOTE.—With a weight of 15lbs. at A, there will be a strain of 5lbs. at B, and of 20lbs. at the block C. This purchase has the same power as the luff tackle, but less friction.

A luff tackle purchase (Fig. 77) is a powerful purchase made with a double and single block, the standing part of the tackle is made fast to a becket or thimble on the upper part of the single block, as at A; it is then rove through the upper double block down through the single block, and up again through the double block, from whence the fall leads as at B. The strap of the upper double block of another luff tackle made fast to the fall C is called a "luff upon luff," and is a very powerful purchase.

NOTE.—With a weight of 15lbs. at No. 1 there will be a strain

Meth

Fig. 73.

Knot completed,
ends of Strands
tapered. Marled and
Served over.

Fig 72.

nds hove taut.

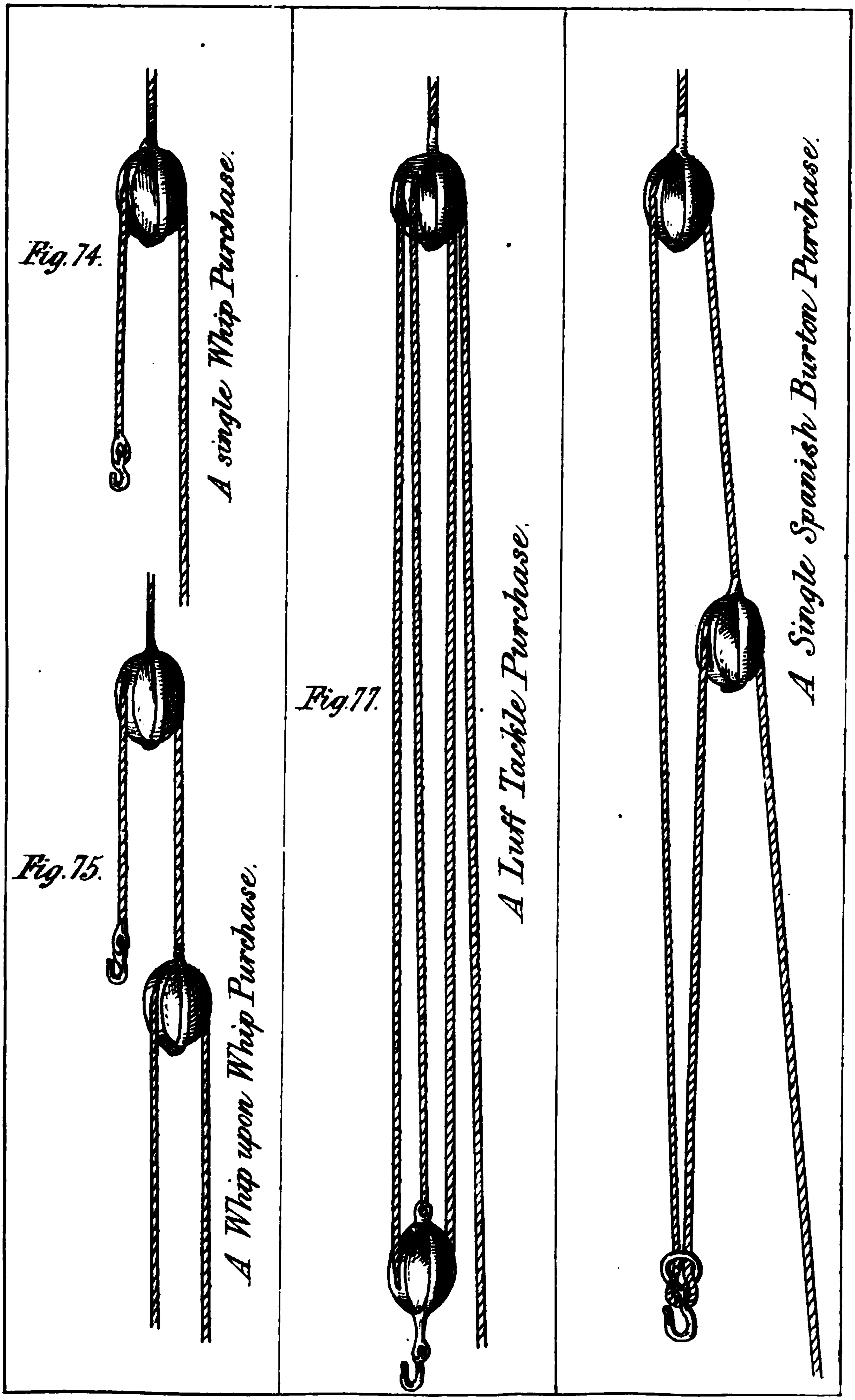


Fig. 74. A single Whip Purchase.

Fig. 75. A Whip upon Whip Purchase.

Fig. 77. A Luff Tackle Purchase.

A Single Spanish Burton Purchase.

A double Spanish Burton Purchase.

A Gun Tackle Purchase Fig 81.

of 5lbs. at No. 2, and of 20lbs. at upper block No. 3. The upper block has always to bear the weight to be lifted and the strain used in doing so.

A watch tackle is the same as a "luff tackle," with the exception that the upper double block is always strapped with a tail to it, and the lower single block is strapped with a good sized iron hook; it is a most handy tackle about the deck for getting a quick and powerful pull upon any particular rope or sheet. To do this, hook your lower block on to any convenient eye bolt, or ring bolt, or by a strap, grommet, or salvagee, to a timber head, take a rolling hitch with the tail of the double block upon the rope or sheet you design to get a pull upon, then two or three hands bowse upon the tackle fall and take in the slack of the rope or sheet, with a turn on a pin or timber head as it comes. A rolling hitch here alluded to, is made as Figs. 78 and 79, (Plate 23.)

A double Spanish burton (Fig. 80) is a very powerful purchase, and is neither more nor less than a "whip or a luff tackle purchase," with the standing parts of the luff and whip toggled on together to the becket of the lower single block at A.

NOTE.—With a weight of 35lbs. at No. 1 there will be a strain of 5lbs. at No. 2, and 40lbs. at upper block No. 3.

A gun tackle purchase (Fig. 81) is made with two single blocks, with the standing part of the tackle made fast to the upper block; this is also used as a reef tackle, and is called a single reef tackle, in contradistinction to the larger reef tackle, which is made with two double blocks, and is called the double reef tackle; they are both handy tackles, and every yacht should be well supplied with them.

NOTE.—A gun tackle doubles the power of a single whip, for suppose A B C to represent the "standing" part, "block," and "fall" of a "single whip" (as Fig. 74, Plate 22), then let us reeve the standing part A through a lower block at D, and lead it up and make it fast to the upper block at E; then if the lower block D is hooked to a weight of 10lbs., it is evident that each part of the whip at D—viz., 1 and 2, bears a strain of 5lbs. each, and each part at the upper block B bears a strain of 5lbs. each, therefore a strain of 5lbs. on the hauling part or fall of the tackle at F, will balance a weight of 10lbs. on the hook at D, and throw a weight of 15lbs. on the upper block B.

A long tackle purchase is the same as that applied to pendant runners and which I have mentioned before.

I extract the following from "Templeton's Operative Mechanics," it is a useful formula.

"The principals of the pully, or more practically the block and tackle, is the distribution of weight in various points of support; the mechanical advantage derived depending entirely upon the flexibility and tension of the rope, and the number of pulleys or sheaves in the lower or rising block, hence by blocks and tackles of the usual kind (viz., those we have detailed), the power is to the weight as the number of cords attached to the lower block, whence the following rules:—

No. 1.—Divide the weight to be raised by the number of cords leading "to," "from," or "attached" to the lower block, and the quotient is the power required to produce an equilibrium, provided friction did not exist.

EXAMPLE 1.—Required the power necessary to raise a weight of 8,000lbs. by a four or five sheaved block and tackle, the four sheaved block being the moveable or rising block.

Necessarily there are nine cords leading to and from the rising block, Consequently $\frac{8000}{9}$=888lbs., the power required.

No. 2.—Divide the weight to be raised by the power to be applied, the quotient is the number of sheaves in, or cords attached to the "rising" block.

EXAMPLE 2.—I require to raise a weight of 1 ton 18 cwt., or 4,256lbs., the amount of my power to effect this object being 500lbs. What kind of block and tackle must I employ? $\frac{4256}{500}$=8·51 cords; of necessity there must be four sheaves or nine cords to the rising block.

As the effective power of a crane may, by additional wheels and pinions, be increased to any required extent, so may the block and tackle be similarly augmented by purchase upon purchase.

It will be well to bear in mind that the upper block of a tackle has always to bear the weight to be lifted and the power applied to lift it, for if this is not borne in mind accidents will occur, and then your block and gear is blamed, and not the want of proper precaution; a reference to the sketches I have given of tackles will illustrate this, and to which I have appended notes and figures descriptive of the same.

For good practical instruction on this point I am indebted to a very excellent little work, entitled "The Mate and his Duties."

The sheaves of blocks were invented for the purpose of overcoming friction, no power is gained by the increase of the size of sheaves,

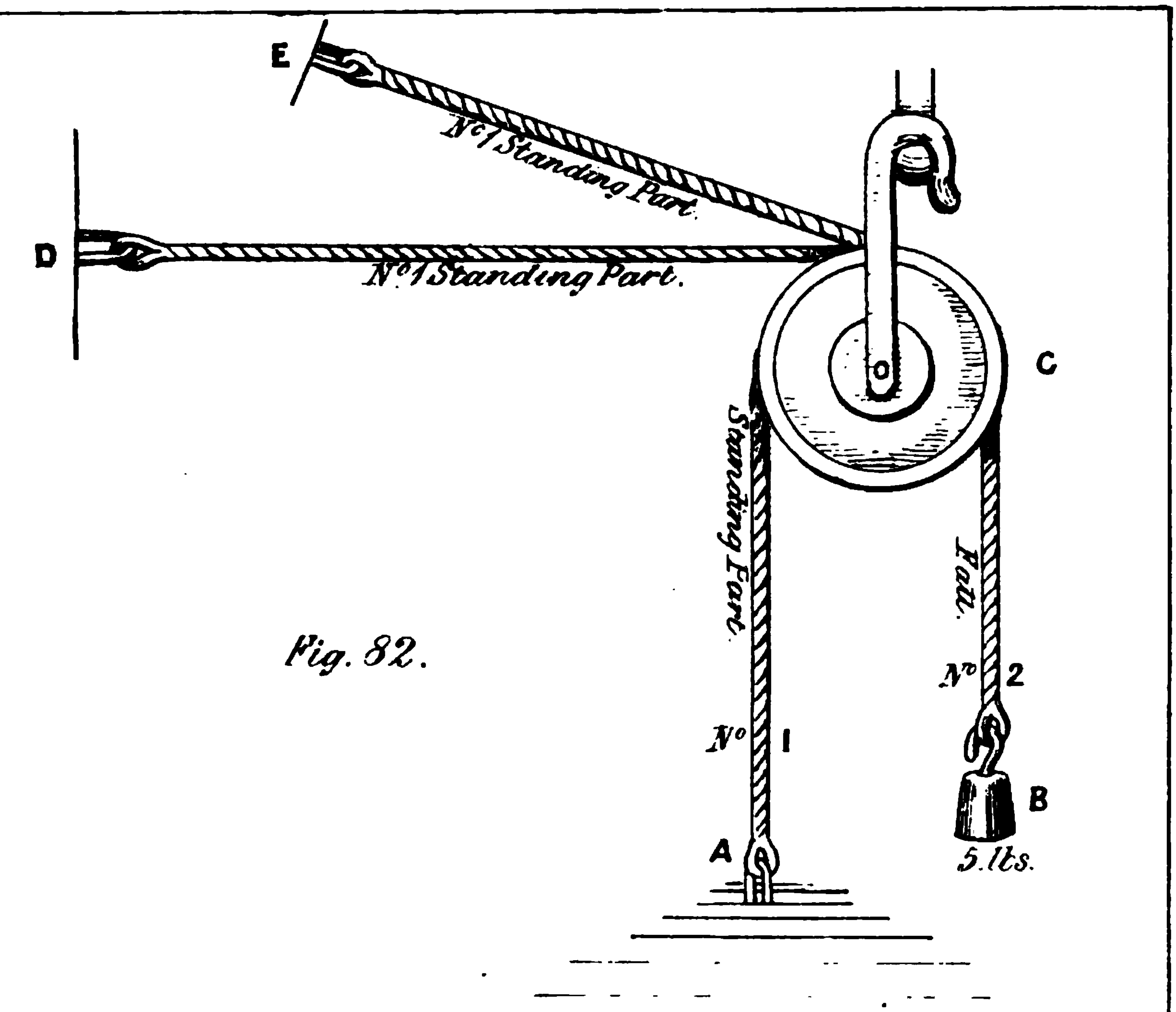

E
D
No 1 Standing Part.
No 1 Standing Part.
C
Standing Part.
Fall.
No 1
No 2
A
B
5 lbs.

Fig. 82.

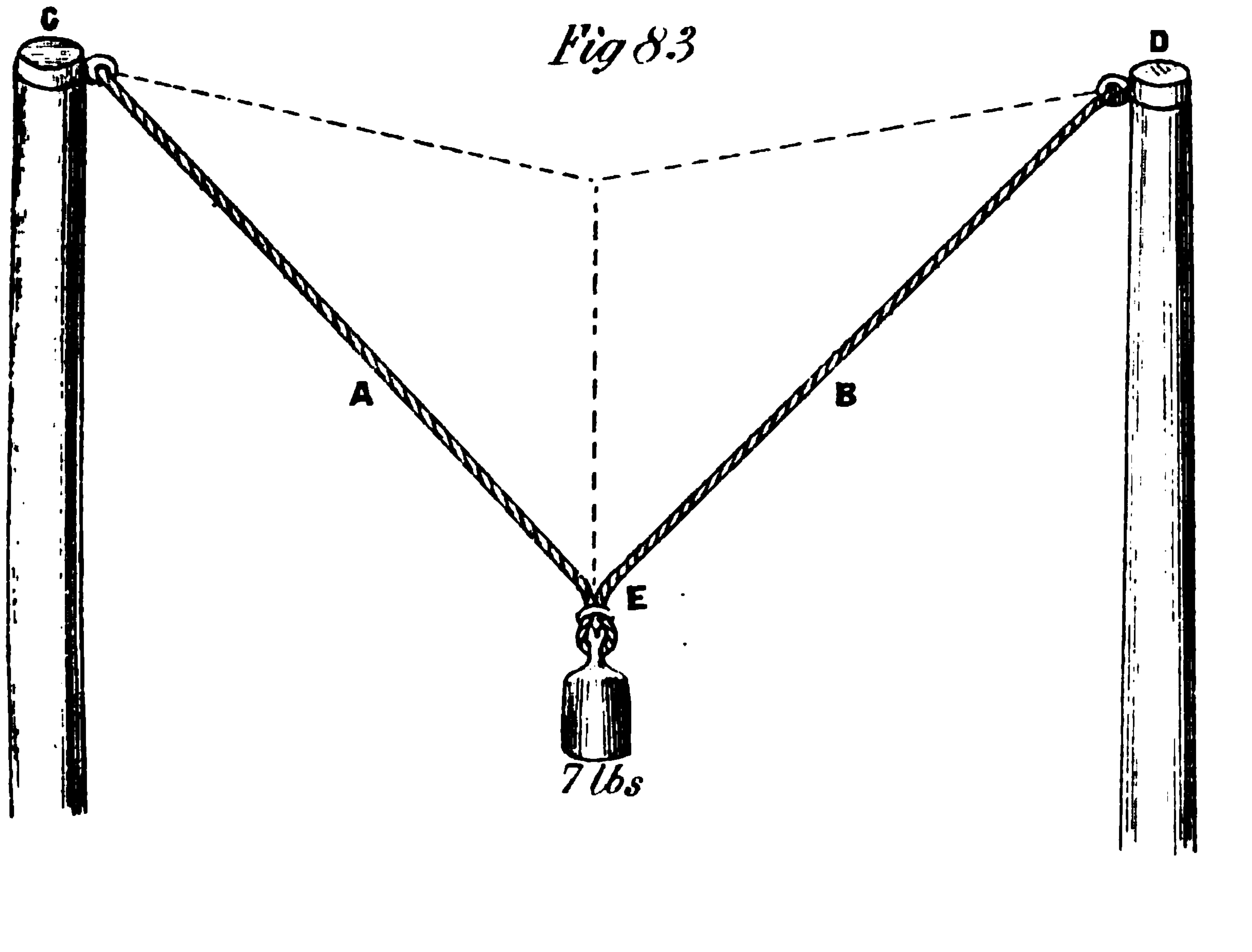

C
D
A
B
E
7 lbs

Fig 83

but in proportion as they are increased in diameter, friction is vastly decreased.

It is worthy of note that the angles, the parts of a tackle or purchase make with each other, greatly affects their power: this I will endeavour to illustrate by Fig. 82, Plate 24.

Here let A B represent a whip purchase rove over the sheave C; let the standing part No. 1 be made fast at A, and a strain or power of 5lbs. be applied at B, then a strain of 10lbs. will be thrown on the block at C; but if the standing part No. 1 be led at right angles, (90) to the fall No. 2, and made fast at D, then the applied power of 5lbs. at B, will only throw a strain of 7lbs. on the block at C: and if the standing part No. 1 be let to an angle of 120°, and made fast at E, then the strain on the block at C will be only equal to the power—*i.e.*, 5lbs.; should the standing part No. 1 be led in nearly a straight line with the fall No. 2, then there will not be any strain on the block at C. Hence it follows that the more obtuse the angle made by the parts of a purchase the better, where a leading block is concerned; but where you want to gain power, the more acute the more effectual.

If ropes from the mastheads, in the form of a span, make a right angle with each other, an inspection of Fig. 83 will show the results.

Here the ropes A and B from the mastheads C and D form a right angle with each other; now the rope E made fast to them, and a strain or power equalling 7lbs. being put upon it, throws a strain of 5lbs. each upon the ropes A and B, and if the ropes A and B be tightened so as to make the angle of the span 120°, then a strain of 7lbs. on rope E will throw a strain of 7lbs. on each of the others; therefore when there are two ropes of equal lengths, with a weight attached to them, except they are close together, each bears more than half the strain.

This should be remembered most particularly when mooring a vessel with chain cables, for if when both anchors are let go, the two cables form a right angle with each, they are, according to the preceding formula, together only three-sevenths stronger than one cable laid right ahead; and if the vessel is hove short until both cables form an angle of 10¾ points, or 120°, then both cables are only as strong as one cable ahead.

For these latter practical remarks I am indebted to that excellent little work—"The Mate and his Duties."

There are some knots, hitches, and bends, which are necessary for a yachtsman to know. I shall enumerate (see Fig. 84, Plate 25) the principal.

No. 1 is a common overhand knot. The form of this will speak for itself as to how it is made.

No. 2 is a "reef knot," sometimes called a "square knot." This knot should be well practised by a yachtsman, so that in a very short time he will be enabled to perform it rapidly and accurately. It should be done without looking at it at all, merely by the feel of the reef points, so that on a dark and stormy night, he may be able to knot up his share of knittles properly along the mainsail, and not feel disgraced in the morning when the reef is being shaken out, to hear some of the men sing out—"Ho lads, who's being tying granny's knots here?"

A granny's knot (Fig. 85) is considered a great disgrace amongst yachtsmen reefers. An inspection of No. 2 will, I think, explain at a glance how the proper knot is made, observing that both parts (*i.e.*, the standing part and fall) of each reef point comes out on the same side of each bight in which it is jammed. An hour's practice will acquire it.

Fig. 86 is a gaff-topsail halliard bend. With this bend you make fast the gaff-topsail halliards to the yard, you pass two turns of the halliard round the yard, and coming up on the third turn pass "over" both turns, round the standing part, down under both turns, over its own part and one of the turns, and stick the fall under the first turn.

The neatest manner of bending gaff-topsail halliards is with a strap and toggle, Fig. 87.

Here No. 1 is the end of the gaff-topsail halliard, upon which an eye is neatly turned and leathered. No. 2 is the strap with its toggle A, which, as such, is generally understood to be made of wood, with the end of the strap, spliced round it, but in this instance it consists of a man rope knot, made upon the end of a strap, large enough to jam in the eye of the topsail halliard at B.

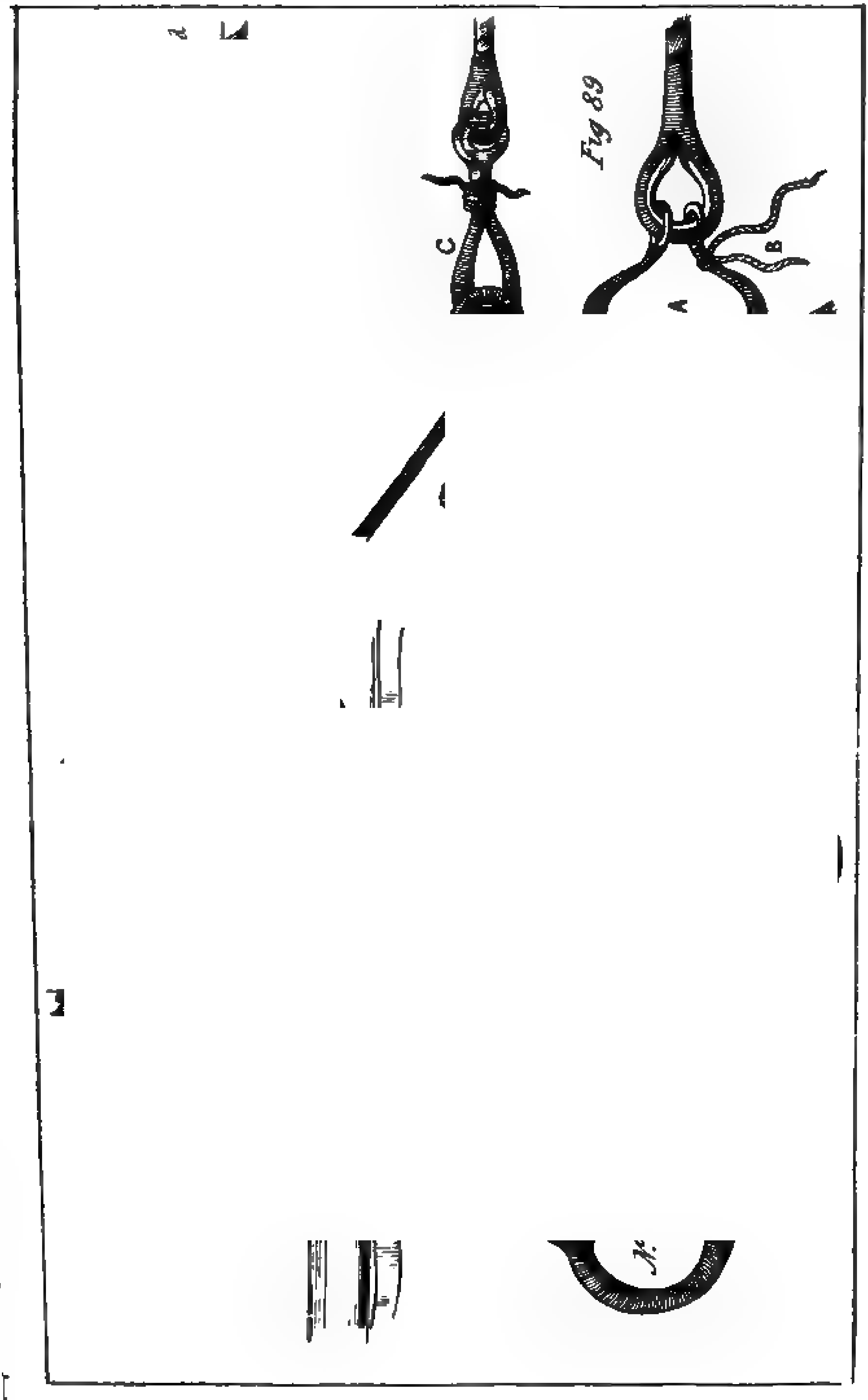
C represents the strap through its eye, and the toggle at the end jammed in the eye of the topsail halliard.

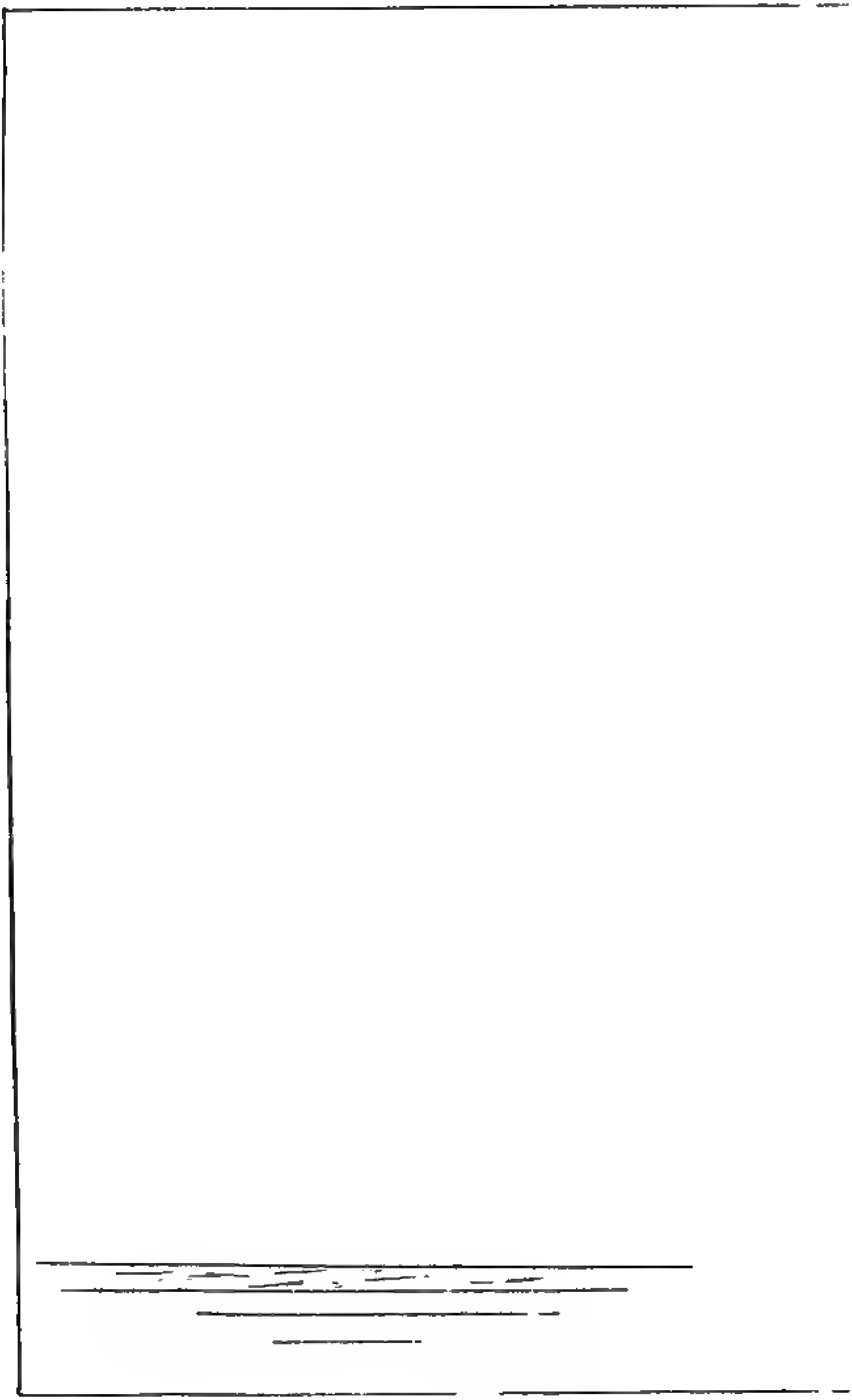
D represents the topsail halliards bent to the yard with the strap and toggle.

I would recommend this mode of bending gaff-topsail halliards to every yachtsman: it is neat, simple, and most expeditious.

Plate, 25

Plate 26





A gaff-topsail sheet bend is made as Fig. 88. But a great number of yachts have their gaff-topsail sheets fitted with clip hooks as Fig. 89. A represents the clip hooks, with their B seizing attached, and C represents them hooked on and seized, and the sail ready to be sheeted home. The seizing is put on for the purpose of preventing the hooks opening when the vessel is in the wind, going about.

The proper method of belaying a mainsheet (Fig. 90, Plate 27), although it may appear superfluous information, yet as my little effusion is meant for amateurs yachtsmen, it may be useful to know it.

Here the main sheet is taken with two round turns over the transom head as at A; thence it is taken up to and round the timber head at B, where it may pass singly round as in sketch (or one or two round turns as the case may require); you then make a bight in the fall of the sheet in your hand, and shove it down between the transom and the bulwark sheeting as at C, and loop the bight over the transom head as at D D; then take a good pull on the fall E, and you jam all taut. To cast off this belay you ease up the fall E, until the bight becomes slack on the transom head; then cast the bight off the transom head, haul on the fall E until the bight is clear of the transom at C, cast the turn off the timber head at B, and keeping a good hold on the fall with the right hand, place your left on the two round turns over the transom head, go down on one knee (if you are going to "pay out" mainsheet), and with your left hand "round over" the two round turns at A handsomely and quickly as you ease up the sheet with your right hand. If you are going to haul in the mainsheet, cast off all turns "but the last;" lead the fall along the deck and when the crew are all ready for the pull "then" cast your last turn off the transom, and let them tail on with a will.

A good main-tack tackle is of the greatest importance on board a yacht, and upon its judicious application a great deal of the standing of the luff of the mainsail depends, we all know that when every sheet is trimmed aft for a turn to windward, of what importance it is to have the luff and tack of your mainsail standing properly; when treating of the sailing of a yacht, I shall speak more fully upon this subject. I have inserted a sketch (Fig. 92, Plate 28), of a most excellent plan of main-tack-tackle.

The common tackle for the main tack is a luff tackle purchase; but in the sketch it will be perceived that there are two double blocks—one

hooked into the tack and the other into the deck eye bolt, and one single block hooked into the first reef cringle. This brings down luff and tackle handsomely, gently, evenly ; whereas, with a luff tackle hooked on to the tack alone, the whole strain comes upon the one point, instead of being divided. If you are on a long stretch to windward, reeve the standing part of the tackle at A, through another single block, which hook on to the eye bolt at A, overhaul the tackle and hook on the standing part to the second reef cringle, and you will not leave a crease in the luff of your mainsail.

Plate 29.

Reef Pennant Bend. Fig 93

Bend formed

Bend Jammed

Plate 30.

## CHAPTER VII.

> "The master calls, to give the ship relief,
> 'The topsails lower and form single reef;'
> Each lofty yard with slackened cordage reels,
> Rattle the creaking blocks and ringing wheels."—FALCONER.

I WILL now proceed to show how to make fast a reef pendant round the boom when the reef is hardened down with the reef tackle, which it is important to know, and requires a smart and strong hand;—Figs. 93 and 94, Plate 29, will aid the explanation. The crew hang on to the reef pendant in order that the reef tackle may be unhooked; you then pass the pendant end round the boom as in the sketch, Fig. 93, jam the bend as Fig. 94, and the reef pendant is fast.

Should you carry away the mast or bowsprit, and that you want to save the spar, when you get the wreck cleared away a bit, you secure it alongside by what is termed "parbuckling," Fig. 95, Plate 30. This operation is very easily performed by simply making fast the bights of two ropes, one round the quarter timber, and the other any place about the main rigging that is convenient, and does not interfere with the working of the sheets or halliards: then pass the ends of the rope down under each end of the spar up the side, and either lash it up on the bulwarks or get it inboard as occasion may require. There are various simple methods of making ropes fast to each other, to spars, ring bolts, warping posts, &c., called Bends, Hitches, and Knots. These a yachtsman should make himself well acquainted with, as many a time and oft during his career, occasions will occur when he may be called upon to make fast a rope under circumstances of importance, where perhaps even his life, as well as those of others, may depend upon its being securely done, without fear of its rendering or giving up; therefore it is necessary that he should have confidence in doing so, and a little practical knowledge, ensured by frequent exercise is sure to beget it.

A common bend is made as Fig. 96, Plate 31. As I trust the sketches of these bends, hitches, &c., will speak for themselves, and

as I know technical explanation frequently tend to perplex the beginner, I shall only make use of them where circumstances may render it necessary.

A Garrick Bend (Fig. 97, Plate 31), is a very useful and secure one, more particularly if you are suddenly required to bend two hawsers together for the purpose of towing or warping a yacht.

A regular Hawser Bend (Fig. 98, Plate 31), is made as by sketch, but as will be perceived, takes a little more time. This is used when it is requisite to join two hawsers together, where an extra length is required.

A Hawser, or a Cable, is bent to a kedge, or a bower anchor, according to either of the sketches, Figs. 99 and 100, Plate 32. Chain cables are now so universally used by all yachts, that a hemp cable is seldom seen on board; but no yacht's ground tackle is complete without a good hemp hawser; it is most useful in various ways: for instance, you may be coasting along with a light wind off the land, it suddenly dies away, and you fall in, perhaps, with a strong ebb or flood tide, drifting you astern at the rate of from one to two miles an hour; then let go your kedge anchor and hawser, and ride over the tide: the anchor being light and the hawser handy to work, you are under way in a moment should the breeze spring up; whereas should you let go the bower anchor and chain cable it is a far more laborious matter getting it aboard again; and should you have to repeat the manœuvre often, proves rather too heavy work. Care should be taken before bending the hawser to the anchor to parcel over the anchor shackle with a piece of old canvas, marled on with rope yarn, in order to prevent the hawser being chafed and cut by the iron shackle.

A Bowline Knot (Fig. 101, Plate 32), is a very useful one. This is called a "standing" bowline knot, in contradistinction to Fig. 102, which is called a "running" bowline knot. In the latter sketch it will be perceived that the loop or eye formed by the knot A, runs upon the standing part of the rope B B, forming another eye above the knot as at C.

A Bowline Knot on a bight (Fig. 103, Plate 33), is another form of this knot. This at first sight may appear rather difficult to make, but it is on the contrary extremely simple, as in fact are all knots and bends, once the principle of making them is understood.

Take the double rope at about two or three feet from the bight and

*Plate*

Plate 32


Fig. 104

Plate 34.

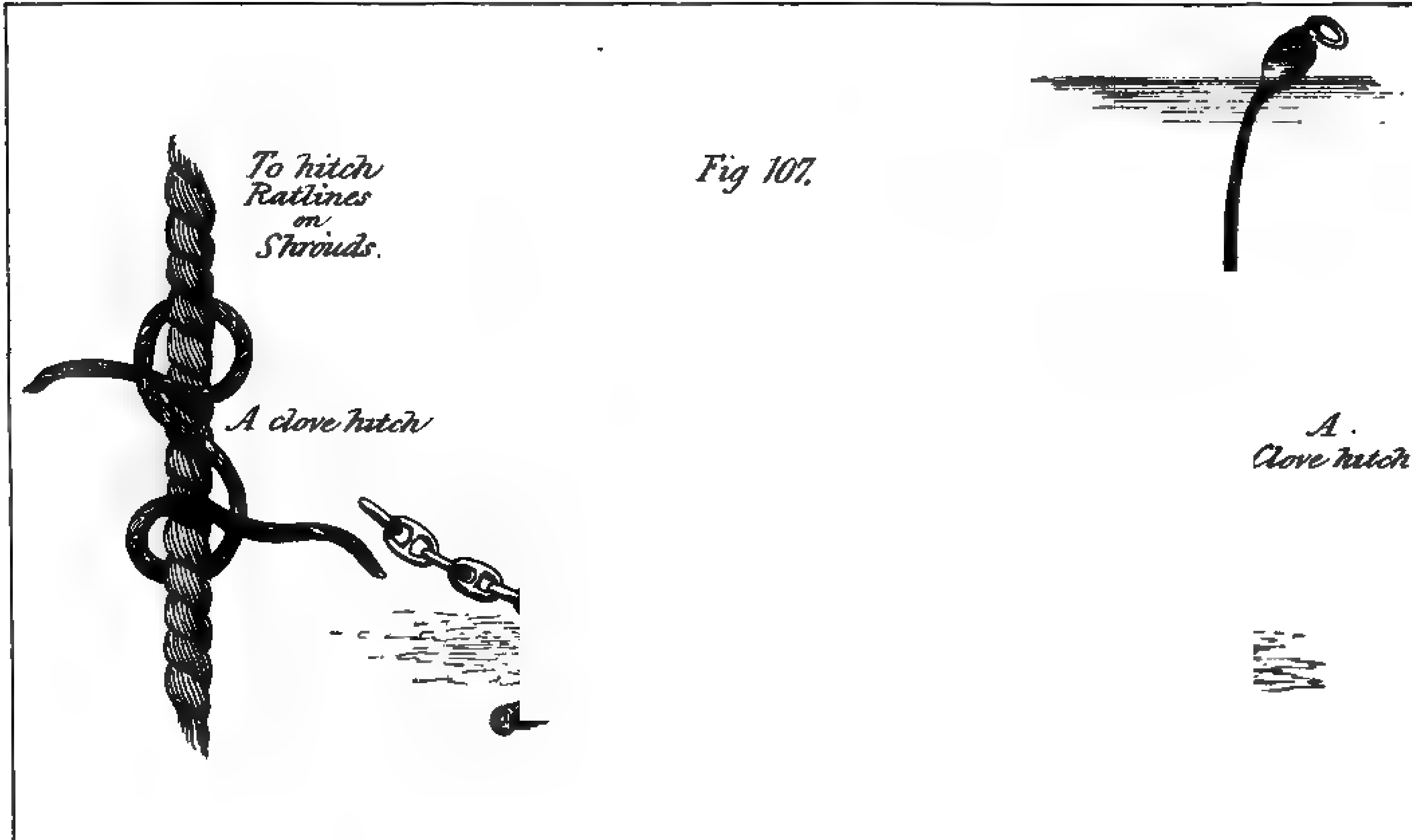


Fig 107.
To hitch Ratlines on Shrouds.
A clove hitch
A. Clove hitch.

make an eye, or as it is termed in technical language a Cuckold's Neck, or Kink, as at A; then pass the bight B up through the eye A, open out the bight B, and then throw it over the large loop C, bringing it up round the standing parts of the rope at D, jam it there and the knot is made. Here it may be well to remind the yachtsman to make himself well acquainted with the technical terms used in making knots or bends.

The "standing part" of a rope is always the principal part, or long portion which is worked upon with the end to form a knot; the noose or eye formed when the end is folded round is called the "bight," and the last part of the rope which is used in making a knot or bend is called the "end."—See Fig. 104, Plate 33. It may appear superfluous on my part to enter into such details, which of course professionals will smile at, but as a yachtsman is only an amateur sailor, he cannot be expected to be made up in such minor details as only a regular apprenticeship to the sea will teach.

The "standing part" of a "Tackle" or "Purchase" is that part which is made fast to the "lower" or "upper block," or to a "timber head," "pin," or "weight to be raised." The "running parts" are those which go over the sheaves in the block or blocks; aud the "fall of the tackle" is the end which is taken hold of in order to apply the power; very little exercise of the brain is required to implant these technicalities in the memory, so that when anything connected with these appliances is to be performed, the right term may be used in the right place.

When towing spars from the shore to the yacht, or *vice versa*, as very often has to be done, such as racing booms, bowsprit, gaff-topsail yards, &c., the knot called a timber hitch (Fig. 105, Plate 33), will be useful. This hitch can be quickly made, and when the weight of the spar strains the rope, the hitch jams itself and will not easily give up. A strop or tail block may be made fast to a rope by this hitch.

The method of making a hawser fast to a wall ring, or round a warping post, or to the ring of a buoy, so that it may not give up at, perhaps, a critical moment, should not escape the yachtsman's attention. By means of a Fisherman's Bend (Fig. 106, Plate 34) is the simplest and securest method, and if you want to make assurance doubly sure, pass a round seizing round the end, on the stranding part of the hawser.

A Clove Hitch (Fig. 107, Plate 35) is that by which the ratlines are hitched round the shrouds, and also a buoy rope made fast to an anchor.

A Blackwall Hitch (Fig. 108, Plate 36) is made with the end of a rope, or the fall of a tackle, on the hook of another tackle; it is very useful when applying an additional tackle, to increase the power of another; or in setting up the rigging you should make fast the end of the shroud lanyard round the tackle hook with a Blackwall hitch.

Another hitch of a similarly useful description is that known as a Catspaw.—See Fig. 109, Plate 36.

A Magnus Hitch is made on the shackle of an anchor, a spar, or a rope, by taking two round turns round the ring or spar, passing the end over the standing part of the line, round the ring, or rope again, and up through the bight, according to Fig. 110, Plate 36.

A Midshipman's Hitch is a very useful one for making fast the sheets of small boat sails, it is made with a half hitch over the standing part, and a round turn above the hitch, which jams it fast.—See Fig. 111, Plate 37.

A Rolling Bend is made by taking two round turns round a spar, and two half hitches round the standing part, as Fig. 112.

There are some knots worked upon ropes which it may be serviceable for the yachtsman to make himself acquainted with. Fig. 113 is the Single Wall Knot, and if my readers will carefully examine the sketch, the description of the manner of making thereof will I think be easily understood. You unlay the end of a rope to a sufficient length, then lay the strands precisely as in the sketch, haul them well taut one by one, cut the ends neatly off, and the knot is made.

A Single Wall Knot crowned, Fig. 114, Plate 38. After the single wall knot is made lay one of the ends over the top of the knot, lay the second end over the first, and lay the third over the second, and "through the bight of the first," and the knot is crowned.

A Double Wall Knot (Fig. 115) is made by making in the first place the single wall as Fig. 113, and not hauling it taut; then crown it as Fig. 114, hauling the crowning taut; take the "ends" and pass them "under" and "up" through the "bights" of the slack single walling, "next" to "them" respectively, and then you will have a double wall knot single crowned.

If a Double Wall and Double Crowned Knot is made, the double wall and single crowned knot is completed, according to Fig. 115. It is made by laying the ends "by the side" of "those" in the "single crown," pushing them through the "same bight" in the single

Fig. 109

Fig. 110
A Magnus hitch

Fig.
A.

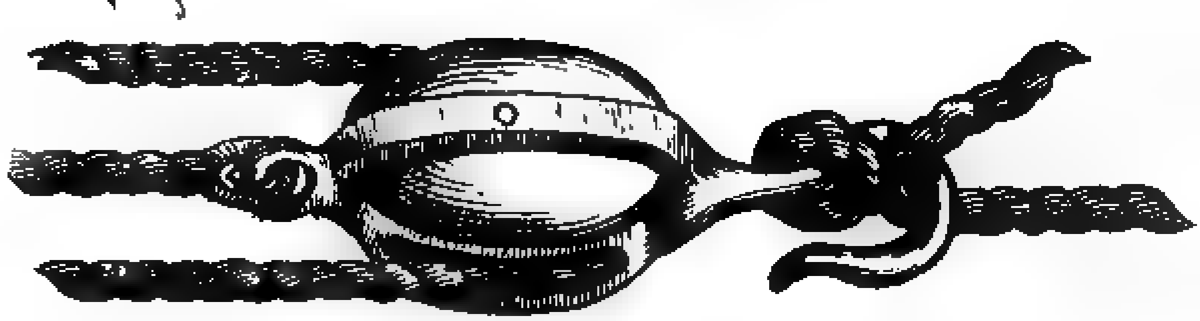


*Plate 3*

Plate 39

Fig. 121

A Gaff Parral.

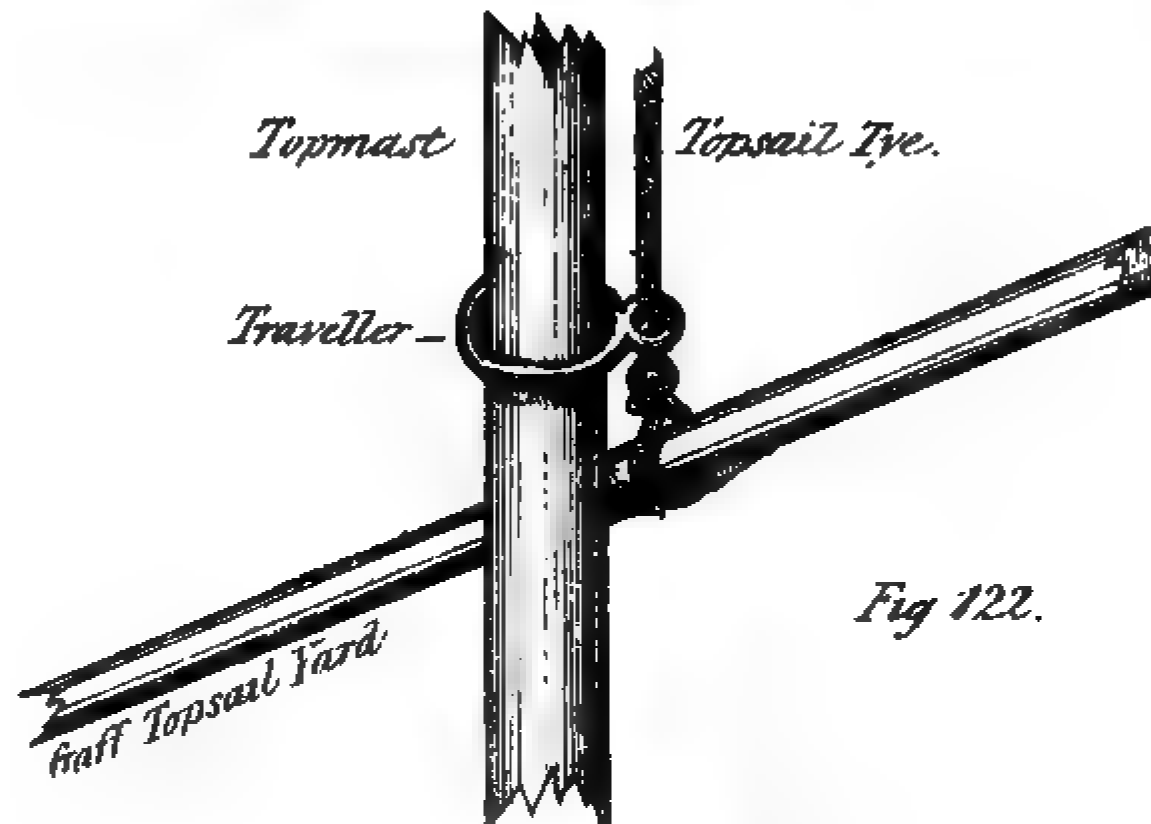
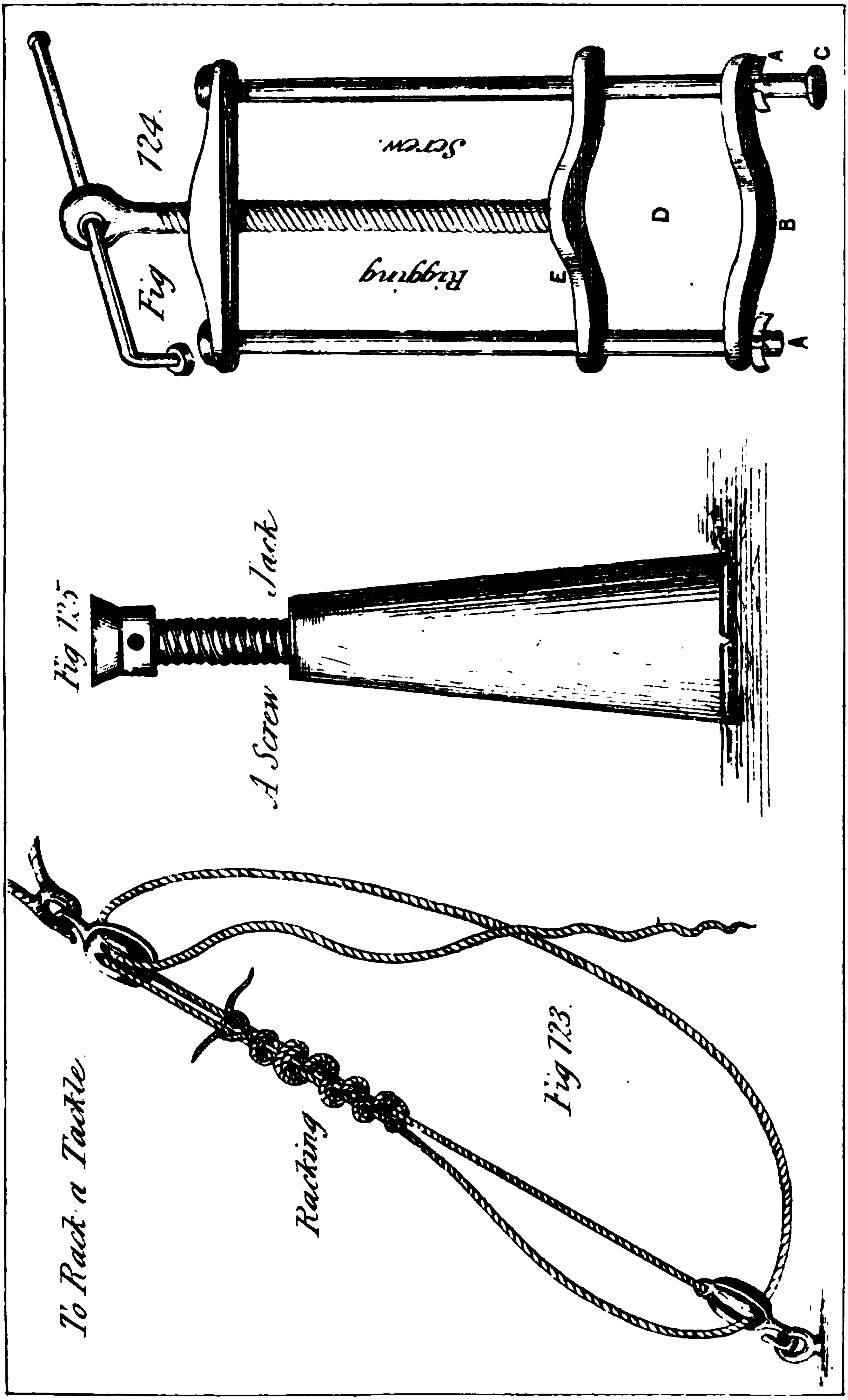



Fig 122.

B

To sling a Cask, or Water Breaker

Plate 41


To Rack a Tackle
Racking
Fig 723
A Screw Jack
Fig 725
Fig 724
Rigging Screw
A
A
B
C
D
E

crown, and downwards through the double walling, as in Figs. 116 and 117.

It might happen that a yachtsman would want to sling a cask up out of a boat. Now, those gallant yachtsmen who "ride along the sea" in noble schooners of some 100 to 200 tons burthen will, of course, smile to read of such an addition to any yachtsman's education: to such like luxurious brethren of our art I would most good humouredly say, there is nothing requisite to be done on the "deep, deep, sea," if you are a votary of the pastime, you should be ashamed to make yourself acquainted with.

You may go ashore on a fine morning with a watering party, and upon your return on board may fancy to amuse yourself by getting the water casks up; and although it may be presumed all hands know how to do that, yet the previous knowledge will do you no harm. Have a sling for such purposes ready on board, made either of rope spliced, or else a long selvagee strap.—See Fig. 118, Plate 40.

Should you carry guns, occasion or amusement may require you to land them, therefore you should know how to sling them into a boat alongside, as even with small pieces of ordnance, hand work is dangerous; a slight swell alongside may cause a man's foot or hand to slip, and then away goes your gun, and perhaps your gig gets stove into the bargain. For this purpose you have slings also, and two methods of slinging are shown by Figs. 119 and 120, Plate 39.

In Fig. 120, there is an eye spliced in the sling at A which fits over the cascabel of the gun.

Parrals are used to confine a gaff topsail yard to the topmast, or the jaws of the gaff to the mainmast, they are generally made with little wooden trucks turned in the shape of a billiard ball, bored through the centre, through which is rove the parral rope, as Fig. 121.

The best and most approved method of confining a gaff-topsail yard to the topmast is by an iron ring, or traveller, covered with leather.—See Fig. 122.

To rack a Tackle or Main-sheet.—This operation is useful in the event of its being requisite to unreeve one of the parts, or from any other cause, where it is necessary to hold on and keep all standing; it is performed with a piece of spun yarn, or any light line at hand, by passing two or more cross turns of the line over the parts of the tackle, &c., you want to keep fast, then take a couple of round turns over all and make the ends fast with a reef knot.—See Fig. 123, Plate 41.

Whipping the end of a rope is done with spun-yarn, and serves to prevent the unravelling of the end of the rope, than which nothing can be more slovenly or unshipshape; and to see a yacht's ropes lying about her decks with the ends all unravelled and jagged, you may depend there is very little regularity or order about her; and it is so simply and expeditiously performed, that no excuse can palliate the neglect of such a useful precaution: you take several turns of spunyarn, or if your rope be small, sail twine, round the end of the rope, then pass the end of the whipping under the four last turns, haul taut, and the rope's end is whipped.

In concluding this chapter I shall say a few more words about blocks; it may be useful for yachtsmen to know something of the makers of neat blocks, and their prices.

There are many excellent blockmakers, but two I may mention from having had personal knowledge of their work: one is Mr. Michael Ratsey, of Cowes, the eminent yacht builder, who furnishes very excellent patent blocks, with the iron strapping inside; some of his blocks were made of ash, rivetted through shells and internal binding with brass rivets, and furnished with patent sheaves; others were made of elm. For these blocks the charge was 1*s.* 6*d.* per inch: when the price per inch is thus quoted, it is meant to signify per inch for each single block, so that a double block is charged for as per inch for two single blocks, a treble as per inch for three single blocks, and so on. As per example which I quote from an account before me.

| | | £ | *s.* | *d.* |
|---|---|---|---|---|
| 1 | 9in. Treble Ash Block (internal binding) with brass rivets & plated sheaves, at 1s. 6d. per inch | 2 | 0 | 6 |
| 1 | 9in. Double ditto. ditto | 1 | 7 | 0 |
| 5 | 9in. Single ditto ditto | 3 | 7 | 6 |
| 1 | 10in. Double Elm ditto ditto | 1 | 10 | 0 |
| 1 | 10in. Double Common Block with patent sheaves at 1s. 3d. per inch | 1 | 5 | 6 |
| 4 | 8in. Single (internal bound) Ash Clump Blocks, brass coaked, at 10d. per inch | 1 | 6 | 8 |
| 2 | 6½in. Single (internal bound) Ash Blocks, brass coaked, at 10d. per inch | 0 | 10 | 10 |
| | For Galvanizing the iron work of ditto | 0 | 10 | 0 |
| 1 | 9in. Double (internal bound) Block, with patent sheaves, at 1s. 6d. per inch | 1 | 7 | 0 |
| 1 | 3in. Single Block, brass sheave, at 5d. per inch | 0 | 1 | 3 |

The chief difficulty about blocks is to get the iron work properly made,

to have sound, good tough iron used in the strapping, and the workmanship free from bad welding, and flaws in the block hooks ; upon the iron work of a vessel very often depends her safety and the lives of her crew so that anything faulty in this department may cause a fatal mishap. I must say from what I have seen that Mr. Ratsey gives general satisfaction under this head.

The second blockmaker whose work has come under my notice particularly is a Mr. Robert Davies, of Birkenhead, Cheshire. I certainly never saw neater blocks than Mr. Davies turns out ; the wood he uses is sycamore, which makes a very handsome block ; brass sheaves, and steel rollers. He will furnish a set of blocks for a fifty ton vessel from £16 to £17, and for a twenty-five ton vessel about £12, of the very best quality.

Elm is considered by blockmakers generally to be the best wood for hard work ; sycamore and ash make what are termed "fancy blocks" for yachts.

Before taking leave of this part of the subject I would again caution yachtsmen that they cannot be too particular about the iron work of blocks, more especially if the iron work be "galvanized."

For iron work which is not galvanized I can recommend the following priming paint,—mix red lead and linseed oil to the consistency of paint, which boil until it burns a feather ; when cool add thereto some of what painters call "Patent Driers," which can be had of any oil and colour merchant ; this is a most excellent paint for iron work.

Another excellent method of coating iron for sea purposes is to heat it to a blood heat, that is to a dull red heat ; then dash it over with a brush dipped in linseed oil ; keep dashing it, or as it is technically termed "striking it," until the iron assumes a glaze, like earthenware, then leave it to cool and harden. No paint you can apply to iron work will equal this.

With regard to the varnishing of blocks, it is desirable to preserve the wood of which the block is made of as good a colour as possible ; and as varnish put on without any preparation darkens the colour of the wood considerably, a preliminary coating of gold size will be found to preserve the original and new-looking colour of the block, and when varnished will always look fresh and bright.

There is a little instrument which no yacht should be without, viz., a pair of rigging screws (Fig. 124, Plate 41), they are most useful for

turning eyes on rigging, and forcing the parts of a rope closely together previous to seizing them; to do this by hand is very labourious and difficult, but with a pair of screws it is done in a moment, the average price is from 12*s*. to £1 a pair, according to the size, and, in fact, a large and small pair will be found generally useful on board. To use the screw take the keys A A out, then the bent cross bar B will drop on the long arm C, place the ropes you want to force together in at D, put the cross bar B into its former place, secured by the keys; screw down the upper cross bar E by means of the handle and screw, and you can bring the parts together as tight as you please for seizing.

Another most useful implement to have on board is a screw jack, (Fig. 125), and in fact no cruising yacht, particularly a vessel bound on a foreign voyage, should be without one or a pair of them. If a vessel gets on shore they are invaluable for bearing her up in order to get ways under her, or in many other cases, such as an injury to the rudder, starting heavy weights, &c.

## CHAPTER VIII.

"In distant angles, the transient gales
Alternate blow, they trim the flagging sails;
The drowsy air attentive to retain,
As from unnumber'd points it sweeps the main.—FALCONER.

NO MATTER what amount of science, skill, and practical knowledge may have been brought to bear upon the hull, spars, ballasting, and rigging of a yacht; unless her sails receive the same amount of attention as to the material of which they are composed, their cut, the workmanship bestowed upon them, the manner in which they are first bent and stretched, their set upon the vessel when underway, and particularly their dimensions, all previous labour, anxiety, and time is absolutely thrown away. In fact, the yachtsman has only two-thirds of his work done, and the remaining third, if left to depend upon the excellence of the other two, will as certainly produce complete failure. For years British yachtsmen travelled the old beaten track, relying upon the skill of known sail-makers to produce the best material, the best workmanship, and the most efficient shapes; they considered name of the maker a sufficient guarantee that each article was the best of its kind, and if the sails of one successful yacht did set a little better, and enable her to achieve wonderful feats in beating to windward, in nine cases out of ten the results were attributed to the superior skill and knowledge of setting them displayed by her sailing master and crew. There is no doubt that in some instances this held true, for certain of our leading yacht skippers have long been well aware of the superior advantages of well cut and flat standing sails, and accordingly bestowed no small pains in the sail loft; understanding this they took much pride in setting of them, which, however, was rendered comparatively easy, owing to the time and attention they had devoted with the sail-maker in designing and cutting them out.

All trades and professions have their legitimate secrets, and why should not yacht captains? they did not feel bound to enlighten others

at their own cost, nor was it reasonable to suppose they should do so. Once the subject of flat standing sails became forced upon the notice of yachtsmen the secret of many a triumph would be laid bare, and reputation for nautical skill, that had hitherto stood unrivalled, would suffer considerably in the market. Whatever knowledge was possessed upon the subject, and that more experienced or enlightened individuals hoarded up for their own immediate ends and glorification, there can be but little doubt that it was not applied so effectively as it might have been; we heard of what were called flat standing sails, of canvas setting like as though carved out of sheets of ivory, of wonderful mainsails, gaff-topsails as large as mainsails, and balloon jibs as large as both combined; then there was a great slack foot to these huge jibs, produced between the superabundance of canvas and the strain exercised by the sheet, which girthed it across from clew to tack, notwithstanding the roaching of the luff; there was balloon foresails as well as balloon jibs, with their clews leading aft the mast in similar proportions, and their after leeches shaking and shivering in the most dismal manner; mainsails were not considered effectual without a slack foot hanging far below the boom, and preposterously rounded after leach, which flapped about when a vessel was on a wind in a most astounding fashion, and which we were gravely told was of great utility, as it "humoured the wind in escaping out of the sail!" The head of the sail was broad, and consequently very square, to enable a vessel to go to windward, and then there was the undeniable topsail with a great square head, laced to a yard heaven knows how long, but which almost invariably evinced a predisposition to a fit of the shivers the moment a vessel looked near the wind. There appeared to be an idea abroad as to the essentials requisite towards constituting the principal of effective sails, but in the attempt to apply them we overshot the mark, and floundered into a quagmire of enormous spars, prodigious sails, and fearful cargoes of ballast. "Give her good walking sticks and plenty of muslin," was the cry; "her hull is fit to do anything!"

The yacht captains, despite their experience, fell into the error of supposing that whatever vessel carried the most canvas must necessarily be the fastest; but to enable the hull to stand up under the cloud of muslin, shifting ballast was resorted to, by the assistance of which races were won, and vessels cheated along by a system of nautical jockeyism, which we flattered ourselves was the perfection of science and skill;

then dawned a new era, and the hulls of vessels began to receive increased attention. Wave line theories were propounded, which, however beautiful in idea, and appropriate to the production of desired results, do not at the present hour appear to be thoroughly understood amongst builders or yachtsmen ; the displacement received a good deal of attention, and beam was pronounced to be antagonistic to high speed ; to remedy the loss of stability consequent upon the narrowing of the beam, long and deep vessels became the order of the day, with their ballast stowed very low, and metal keels and keelsons, and the adoption of lead to keep them on their legs, owing to their increased proportional depth, these vessels were possessed of greater lateral resistance, and consequently went to windward of the old beamy ships, whilst from their comparative narrowness of beam and great rise of floor, their transverse displacement being so much reduced, enabled them to run with a speed far outstripping their ancient competitors ; occasionally, however, the old ocean lassies had a hearty triumph over their juvenile and more fashionable rivals when they got them in a good weighty sea, with a rattling gale of wind, the antiquated ladies made up for their deficiency in speed by their more weatherly qualifications, for slow vessels are notably easy in a rough sea.

Next came the sharp bows, cut away runs, and great rake of stern posts ; men discovered that, by increasing the draught of water, giving a great rise of floor, and raking the sternpost, they obtained a vessel of a low racing tonnage, with the deck room, spars, and spread of canvas of a yacht 10 or 15 tons larger ; in the rage to accomplish this legalized cheating ability, seaworthiness, and all the good qualities a vessel should possess were sacrificed ; daring, superior skill, and artificial appliances were to compensate for the absence of these, and yachtsmen triumphed in the idea that a class of racers were introduced that nothing could exceed in speed : canvas flourished in proportions that made sea-faring individuals stare : shot-bags were not enumerated singly, but by the ton ; spars towered into the skies, or reached horizontally, that made sailor men wonder how the hulls they grew out of were able to carry them ; we had indeed reached what was pronounced to be the desideratum of a racing yacht, viz.—the least possible displacement, the greatest amount of stability, and the maximum of the means of propulsion ; we had a little ship below the water, and a great ship aloft ; and if she did sail upon her beam ends occasionally, and was a little wet, why it was

entirely owing to superior speed—speed--speed—speed! that was the cry,—"their superior speed must make them wet!" It did not occur to many that it was not the speed that the vessels were going at that made them wet, but the pressure of enormous, ill-fashioned sails driving them into, and not over the seas, which their cut-away hulls were not able to lift at. The feats that have been accomplished by many of the English racing yachts of this description, and that are still accomplished, are perfectly astonishing; but then their most brilliant performances have been in smooth water and light winds; when caught in heavy weather at sea they have behaved wonderfully, but certainly not owing to their own abilities, for they have been just kept afloat—living, as it were, by the most accomplished seamanship and reckless daring; they passed from port to port under storm canvas, and their owners—prudent men—travelled snugly in first-class carriages, knowing that British sailor men can always be found that will man a coffin if it be got under canvas, perfectly satisfied at seeing their sideboaads filled with plate, and, so far as the nautical predilections extended, a summer day's cruise, with a "fair companie" and plenty of champagne in the ice-well, fully satisfied them.

This system of building yachts and railing them has been, and still is productive of serious injury; it has driven, and does drive, good men and true, sailors every inch in principles and practice, from contending for the laurels of the deep, and it is feared must continue yet a little while, until the universal adoption of a proper system of admeasurement for tonnage shall have the yacht builders free and unshackled to produce vessels that shall combine all the necessary qualifications of speed, accommodation, and sea power. The realization of this improvement—so much to be desired rests altogether in the hands of yachtsmen themselves.

On the 15th of March, 1851, we were favoured with a sketch in the *Illustrated London News* of a yacht building at New York to compete with those of the old country: the form appeared so novel, and so entirely opposed to our notions, that very many considered the whole affair a piece of "Barnum," or perhaps the freak of some wild enthusiast. "What! compete with English yachts?—pooh—pooh; she'll get well thrashed if she comes here!" were the observations heard on every side. There was not a yachtsman from the Island of Unst to the Island of St. Agnes that would not have voted a straight waistcoat to

the man bold enough to declare that England would be defeated—shamefully beaten—in a contest upon her native element. By-and-bye, however, tales of Baltimore clippers, American pilot-boats, and American clipper ships, began to be revived, and it was discovered that there was a real *bona fide* yacht club in New York. Would this to-be renowned clipper come? The *New York Spirit of the Times* settled this question on the 22nd of June by informing us that she had actually sailed, and shortly afterwards expectations, feverish longings were appeased by the information that the "wonder" had actually crossed the Atlantic, and was safely moored at Havre. Then the merry badinage was replaced by a serious smile; for we could not any longer designate the undertaking as a humbug; a British pilot had taken her up—had actually sailed in her: she was no myth—no phantom ship—but in his eyes simply a "wonder." Well, English yachtsmen wondered what vessel was to meet her, and then the love letters that we had been writing to ourselves were pronounced, as a great many documents of a similar nature invariably are, to be all "bosh!" Yachting writers suddenly discovered, before the Yankee clipper made her appearance at all, that we had no large vessels built in England on "new and improved principles" fit to compete with her, although, after thirty years of match sailing, we had glorified ourselves into the idea that we were invincible; what the "new and improved principles" were upon which a vessel should be constructed to compete with the coming wonder, we were not enlightened upon, nor I suspect should we have been had she not arrived.

Thursday, July 31st, 1851, may be logged down as the commencement of a new era in English yachting; on that day the America first made her appearance amongst us, and the commotion she excited was sufficient proof that in every respect she differed from our notions of what a fast, sea-going vessel should be. The remark of that veteran yachtsman, the late Marquis of Anglesea, will be repeated amongst yachting men for many a year to come, "If she is right, we must be all wrong!" said the hero of many a fight and jolly cruise. What a world of meaning is comprised in this terse remark of the gallant veteran! She proved herself right, and that we were, not all wrong, but very nearly so: had he written a learned disquisition upon the subject, he could not have hit it off more completely. Our first idea was, that the secret of her success lay in the formation of her hull: that

long sharp entrance, with flanched out upper works, giving the appearance of a great hollow in the forebody lines, had never been seen in any English schooner; the position of the midship section was not unknown to us; the formation of her stern was new, and her upright sternpost was at variance with our practice. Our builders admitted, if not publicly, at least tacitly, that her hull was perfection; her triumphs over the yachts of England settled that question; and then almost every vessel of any notoriety was hauled up on the slips to receive the American bow—yes, the American bow became the desideratum, and yachts with afterbodies of all shapes and descriptions, were to be converted into out-and-out clippers, by removing the "cod's head." Some were improved, and some were overdone: such bows as were produced the like ne'er was seen on this or t'other side of Jordan; then, lo! a new light burst upon us—her canvas! Aye, we were so lost in rapture about the hull, that her canvas escaped our critical attention at first; then we discovered that such a material, such a cut, and such flat standing sails had never been seen—the sail-makers admitted, frankly and honestly, that their like was never seen.

A veteran skipper remarked to me—"Aye, sir, she is a picture,—look at her now getting under way; she goes right up over her moorings in the wind's eye, as if she had a screw in her tail!"

There was little canting of her to get her underway a gentle divergence, and she was off like a seagull on the wing! the same applied to her in full career; once her sheets were hauled aft, she looked up where she was wanted to, and went the speed too. Her match with the Titania proved this more than anything. On the run she did not exhibit that wonderful performance that her superior shape of hull would lead one to expect, but the moment both vessels started on a wind the America was there, the Titania nowhere. To what then are we to attribute the great success of the America? The answer is short,—to the application of untrammelled practical experience in every detail in the construction of a modern hull, that combined in itself all the essentials of speed and ability, without any reliance upon artificial assistance, and the fitting of that hull with the means of propulsion based upon the principle of the minimum of cause with the minimum of effect. Half the success of the America resulted from the exquisite proportion, cut, and material of her sails. I doubt much whether their equals have since been seen.

Then there is another and very important element in the construction and fitting of a yacht, which tends more than anything to success, and that is, the proper adjustment of displacement and driving power, and we are quite sure that in this respect the America had no rival, and have a strong idea that her great achievement may in part be attributed to the care and attention bestowed upon her in this important matter.

The material of which the America's sails were made deserves some more distinctive name than mere canvas. I have a piece of it now before me as I write, obtained for me from the maker by a well known New York yachtsman. When I first received it I remember showing it to a veteran of the sea, whose whole long life had been spent yachting, and who imagined there was nothing new in that line he had not seen; he had seen the America, examined her, as he said "most super-minutely," and yet, strange to say, further than noticing her sails being very neatly cut and made, he never noticed the canvas itself. When I asked his opinion of it, his words were few—"A craft 'should' sail with stuff like that over her; it is more like veneer board than canvas."

## CHAPTER IX.

"For lo! propitious to our vows, the gale
With milder omens fills the swelling sails;
To-morrow's sun shall see our ships explore
These deeps, and quit your hospitable shore."—DAY.

IN the selection of canvas for making a suit of sails a yachtsman cannot be too particular; whether good or bad material be put in them, the cost of making will be all the same; but badly woven canvas will not last in form or work any length of time, whereas a first-rate material when well cut and made up, if it receives fairplay in the handling, will work until the last rag leaves the bolt ropes; therefore the worst economy a yachtsman can exercise is in clipping down and paring the expenditure under the head of sails.

Since the America made her appearance amongst us, greater attention has been devoted to the manufacture of canvas for the sails of yachts, and very great improvements have resulted therefrom, principally in the production of a closer woven and stronger material than we had heretofore been accustomed to.

Canvas is manufactured of different degrees of weight and strength, according to the situation of the sails for which it is intended to be used; these are expressed by numbers, thus the heaviest and strongest is No. 1 canvas, and then continue Nos. 2, 3, 4, 5, 6, 7, up to 8, after which we have the very light ducks. The width of canvas used formerly averaged twenty-four inches, and eighteen inches, but it can now be had twenty-two inches, fifteen inches, and twelve inches, in fact it can be manufactured specially to any desired width, but as it occupies some time, the yachtsman who wishes his sails made with canvas of narrower or intermediate width to the above, must give reasonable notice to the manufacturer; he will do well therefore to bear in mind that the present widths to be had are 24, 22, 18, 15, and 12 inches.

Flax canvas should be made of the very best long flax, fresh, and clean dressed, without any lumps, patches, or dark specks, and perfectly free from tow; the yarns should be very evenly spun, and well and

firmly twisted; the "warp" "or chain" (*i.e.*, the longitudinal yarns) should be whole wrought throughout, and in the stronger or double canvas, should consist of double threads; the "weft" or "woof" (*i.e.*, the transverse yarns) should be of the same substance as the warp yarns, and both should be very closely woven, or as it is technically termed "well struck" together. The flax which is generally used in manufacturing canvas is of British and Irish growth, as also long white Dutch, long white Flemish, Revel, Riga, Pernan, Narva and St. Petersburgh. Of these the British and Irish growth are the best, the latter particularly.

In the selection of canvas some little acute observation and practical experience will be requisite: the yarns should present an appearance on the surface of the canvas as if white beads were sewn over it; this will convey some idea of the even spinning of the yarns, and the regularity and closeness with which they should be struck together; if they do not present this appearance, and if on the contrary they appear thick in some places, and with patches of loose, or swelled out stuff and thin wiry spots in others, and that when held up to the light looks cloudy, with spots of light and patches of darkness through it; that canvas is not properly woven, neither is the proper material in it, and it is not worth much; threads of from a foot to two feet in length should be taken out of both warp and weft of each sample submitted for selection, and their respective strength tested by snapping with the hand; then four strips should be cut of exactly the same length and width out of every two samples; two strips in the direction of the warp, and two strips in the direction of the weft; let the warp slips be slip at one end and slipped through each other, and the weft slips in the same manner; then attach one of the outer ends to a post or rail, and apply weights to the other, and observe which slip of each description breaks the first; as a matter of course the best and strongest will remain intact; another method by which sailmakers judge canvas is that of boring holes in it with a fid; if the threads give up and break easily whilst doing so, the material is bad. The reasons for all this particularity in the selection of canvas are these; badly woven canvas, even although made of good material, will stretch in such a manner as to set at naught all the skill of the most accomplished sailmaker; no matter what time, skill, and attention he may have devoted to cutting out and sewing together, the moment the sails are exposed to the action of the wind and weather, they dispose

themselves in any or every shape rather than the one in which they were fashioned; consequently they never will fit or set well, get into all sorts of bags and bellies, and fail in the requirements for propulsion. Canvas well woven and yet made of bad material cannot be depended upon; it will likewise stretch to a great and injurious extent, and what is still worse, in strong winds when perhaps the safety of a vessel and the lives of her crew depend upon the sails in clawing off a lee shore, or any other position of difficulty, they will split right up or across, or perhaps take flight altogether out of the bolt ropes. With either of the above qualities of canvas the desideratum of good sails must be forfeited; namely, good cut and flat set, irrespective of these, canvas should if possible be impervious to wind, if it is not, the propelling power cannot be fully realised, and we spread an extra quantity of sail from which we derive no proportionate benefit. Canvas should be woven or struck together so closely as to resemble horn when held to the light, and should stretch but little; canvas that is weak and stretches much (irrespective of its losing shape), lets the wind through it like a sieve.

The America's sails introduced cotton canvas prominently to the notice of yachtsmen in this country; the cloth of which her sails were made was twenty-two inches in width, but in the middle of each cloth was woven a false seam, of which more anon. The cotton cloth is no doubt a beautiful material for sails; made of the same substance as flax canvas, it will relatively be much lighter, but at the same time it will neither be so strong nor so durable; it is stated to be very liable to mildew, but with regard to this I think much depends on the care and usage sails get; and so far as mildew goes, I should not apprehend any more difficulty with cotton sails, than with flax; attention to them when they are wet and not making them up into a hard furl and leaving them there, will tend to prevent injury; wet sails should be made up in a very loose furl, so as to let as much air as possible through them, and the moment circumstances admit of it they should be shaken out to dry or air; in fact if it is practicable and the weather will admit of it, even though it rains, it is far better to keep the sails hoisted when they are wet than to stow them in a soaking furl; it is this practice that generates mildew in sails; so long as a sail gets plenty of air, whether it be wet or no, there is little fear of mildew.

If a yachtsman goes to such men as Lapthorn, of Portsmouth, Charles Ratsey, of West Cowes, or Alexander Menzies, of Greenock, he may

reckon upon good material being submitted for his selection, and their cut and workmanship will be testified amply; but at the same time a yachtsman should make himself well up on such matters and be able to say what is right and what is wrong, for if he does not know how to canvas his vessel properly, he can hardly expect to arrive at perfection in sailing her.

There is too much in the trade of sail making to expect, or indeed to render it necessary for a yachtsman to make himself acquainted with all its minute details; but at the same time, if he has the opportunity of studying in a sail loft, and of acquiring the principles of cutting out, sewing, and roping; he will find it to stand him in good need. Next to the material and cutting out, good workmanship and proper roping is essential to produce a good article and very great nicety and long practice is requisite to rope a sail properly. I have often seen faults in sails which were attributed to faulty cutting, and which a slight alteration in the roping completely remedied; many an exquisitely cut sail has been spoiled by an inexperienced hand roping it; and therefore when a sail is bent, and a fault discovered, it must not be always laid at the door of the man who cuts it out.

As a general rule, the narrower the canvas is of which a sail made, the better it will stand; eighteen-inch canvas has been generally used for this purpose in the south of England; but in the Clyde I have seen fifteen-inch canvas used. As I before stated, the America's canvas was twenty-two inches in width; but in the middle of each cloth there was woven a false seam, in order to give it rigidity, so that, in point of fact, each cloth was but eleven inches in width; sails made of such narrow canvas would be very rigid and flat, but then a sewn seam at every eleven inches would, when taken in the aggregate, present a very serious obstacle to the wind in its passage along the sail; it was to obviate this, and at the same time to secure the rigidity of narrow canvas that the false seam was woven in the America's cloth.

Let any one take pieces of canvas of the same substance, and equal in number to the cloths of a mainsail, and sew them side by side, this will give a fair idea of the resistance offered to the wind by the seams of a sail when a vessel is close hauled; but on the other hand, it can hardly be doubted that the flatness and rigidity which can be attained with narrow canvas compensates amply for this extra resistance. The ingenuity which prompted the application of the false seam above re-

ferred to is very admirable; and was our eighteen-inch canvas generally woven with this false seam it would be an immense improvement. I have seen some that had been made so in imitation of the American cloth, and it certainly was perfection.

Sails made with the cloths placed horizontally do away with the possibility of vertical resistance when the wind is brought to act upon them at the most available angle for working a vessel to windward; and competent authorities assert that it is the best manner in which to construct sails for fore-and-aft rigged vessels. I give an extract from the letter of one of the first sailmakers in England in further confirmation of this: he says, "I have just bent a suit of sails with horizontal seams on a cutter yacht of sixty-five tons, and from what I have seen I believe it to be the most desirable plan if a person wishes to have perfectly flat sails, either for a cutter or a schooner!"

The large American sloop, the celebrated Maria, of which we have heard so much on this side of Long Island, has her sails made with the cloths placed horizontally; the length of her mast is ninety-one feet, of her boom ninety-five feet, and of her gaff fifty feet; from these measurements some idea may be formed of the size of her mainsail.

One of the handsomest and flattest standing mainsails I ever saw was made with the cloths radiating from a centre, struck at or a little beyond the stem, so that the selvage of the uppermost cloth lay parallel with the peak of the gaff.

So much, however, have we been accustomed to sails being made with the cloths vertical, that we cannot reconcile any deviation from established custom with our notions of the way things should be. Very few yachtsmen are disposed to experimentalize with yachts or their equipments; it is rather an expensive hobby when indulged in to any extent, unless the individual making the experiment has satisfied his own mind as to its feasibility; but if our gallant yachtsmen would occasionally occupy some few of their leisure hours with a scale of equal parts, a pencil, a T square and a drawing board, they would find many difficulties smoothed away, and be more ready to investigate the subjects of improvement or advancement to their own satisfaction.

Previously to going into any detail as to the cut and dimensions of sails, I will give estimates for full suits for the two classes of yachts I have heretofore specified. The number of yards of canvas in each sail may vary according to the shape thereof; the prices of the canvas may

likewise vary according to the state of the market, but approximately I think these estimates will be found pretty correct.

Complete suit of canvas for a racing or cruising cutter of twenty-five tons:—

| | £ | s. | d. |
|---|---|---|---|
| Mainsail—380 yards of No. 3, 18in. double warp canvas at 2s. 1d. per yard | 39 | 11 | 8 |
| Foresail—78 yards of No. 3, 18in. double warp canvas at 2s. 1d. per yard | 8 | 2 | 6 |
| 1st Jib—128 yards of No. 7, 18in. single warp canvas at 1s. 10½d. per yard | 12 | 0 | 0 |
| 2nd Jib—100 yards of No. 4, 18in. single warp canvas at 1s. 11½d. per yard | 9 | 15 | 10 |
| 3rd Jib—65 yards of No. 3, 18in. single warp canvas at 2s. per yard | 6 | 10 | 0 |
| 4th Jib—30 yards of No. 3, 18in. single warp canvas at 2s. per yard | 3 | 0 | 0 |
| Balloon Jib (clew to come aft mast)—160 yards of 18in. duck, at 1s. 11d. per yard | 15 | 6 | 8 |
| 1st Gaff-topsail—133 yards of No. 7, 18in. single warp canvas at 1s. 10d. per yard | 12 | 3 | 10 |
| 2nd Gaff-topsail (16 feet yard)—112 yards of No. 6, 18in. single warp canvas at 1s. 10½d. per yard | 10 | 10 | 0 |
| 3rd Gaff-topsail (jib headed)—80 yards of No. 5, 18in. single warp canvas at 1s. 11d. per yard | 7 | 13 | 4 |
| Balloon Gaff-topsail—90 yards of linen, 3 feet wide, at 2s. 2d. per yard | 9 | 15 | 0 |
| Spinnaker—made of light duck, 140 yards at 1s. per yard | 7 | 0 | 0 |
| Storm trysail (length of gaff 12 feet)—120 yards of No. 3, 24in. double warp canvas, at 2s. 1d. per yard | 12 | 10 | 0 |
| | £153 | 18 | 10 |

The trysail should have a short boom to come from mast to stern post, as should it so happen that the yacht should be put in a position where short tacks in narrow waters were necessitated, the boom would be found of the greatest service, and a short boom carried on deck with the other spars is but a small addition to the number.

The canvas used in making a suit of sails such as the above, and at the prices quoted, should be of the very best make and material, as also the workmanship that of skilled artizans; the sails should be roped with the very best bolt rope, all thimbles should be of copper, and all head lacing, hoops and hank seizing holes to be properly fenced and stitched, and such lacing holes as require it to be fenced with brass or composition thimbles. About three weeks should be ample time to com-

plete such a suit, but of course many hands make light work, and a shorter period might suffice; but as things done in too great a hurry are never done well, I should recommend the longest time that can be given to a maker, in order that he may be enabled to do himself and his employer justice.

Complete suit of canvas for a racing or cruising cutter of fifty tons:—

| | £ | s. | d. |
|---|---|---|---|
| Mainsail—540 yards of No. 1, 18in. double warp canvas at 2s. 2d. per yard | 58 | 10 | 0 |
| Foresail—116 yards of No. 2, 18in. double warp canvas at 2s. 2d. per yard | 12 | 11 | 4 |
| 1st Jib—205 yards of No. 7, 18in. single warp canvas at 1s. 11d. per yard | 19 | 12 | 11 |
| 2nd Jib—164 yards of No. 3, 18in. double warp canvas at 2s. 1d. per yard | 17 | 1 | 8 |
| 3rd Jib—125 yards of No. 2, 18in. single warp canvas at 2s. 0½d. per yard | 12 | 15 | 2½ |
| 4th Jib—87 yards of No. 2, 18in. single warp canvas at 2s. 0½d. per yard | 8 | 17 | 7½ |
| 5th Jib—46 yards of No. 2, 18in. single warp canvas at 2s. 0½d. per yard | 4 | 13 | 11 |
| Balloon Jib (clew to come aft of mast)—245 yards of duck at 1s. 11d. per yard | 23 | 9 | 7 |
| 1st Gaff-topsail—210 yards of No. 7, 18in. single warp canvas at 1s. 11d. per yard | 20 | 2 | 6 |
| 2nd Gaff-topsail (yard to be 25 feet)—180 yards of No. 6, 18in. single warp canvas at 1s. 11d¼. per yard | 17 | 12 | 0 |
| 3rd Gaff-topsail (yard to be 10 feet)—140 yards of No. 4, 18in. single warp canvas at 1s. 11½d. per yard | 13 | 14 | 2 |
| Balloon Gaff-topsail—180 yards of duck at 1s. 11d. per yard | 17 | 5 | 0 |
| Spinnaker—made of light duck 190 yards at 1s. per yard | 9 | 10 | 0 |
| Trysail (gaff to be 15 feet)—175 yards of No. 2, 24in. double warp canvas at 2s. 3½d. per yard | 20 | 1 | 0½ |
| | £253 | 17 | 5½ |

The remarks I have made relative to the twenty-five ton cutter's sails are equally applicable to these. Of course the above list of sails may be curtailed in number, and the expense of fit-out thus reduced; for instance, a yachtsman merely cruising at the commencement of his career might not require his balloon sails or spinnakers—he might also dispense with some of the jibs and topsails; in fact, merely getting the general working and storm sails; thus he might reduce his first outlay considerably and satisfy himself that his vessel was worthy of a full

working suit for fair weather or foul. If he goes in for racing from the outset he cannot do without the number above enumerated, for he must be prepared at every point and for every shift of weather.

In addition to these there would be mainsail and foresail covers, which for the twenty-five ton vessel would amount to about £2 15s., and for the fifty ton to about £3 15s.

Sailmakers' hammock cloth charges are about 10s. each, but then they are a superior article, and when properly made up show well in a neatly ordered forecastle.

Generally speaking, yacht sailors are very handy with the palm and needle, and in securing a hand who is somewhat conversant with sail-making the yachtsman will find it much to his advantage and comfort, even at a few shillings per week additional wages; thus any repairs to the vessel's sails, alterations in roping, taking up slack cloth, making of boat sails, awnings, hammock cloths, smoke sails, wind sails, skylight covers, fenders, sail covers, and a thousand and one little odds and ends which can well be done on board, will give a smart hand, assisted by his shipmates, legitimate occupation during their leisure hours, and will contribute much to the proper economy to be observed on board.

## CHAPTER X.

"That task performed, they first the braces slack,
Then to the chess-tree drag the unwilling tack,
And while the lee clew garnets lowered away,
Taut aft the sheet they tally and belay."—FALCONER.

IN an excellent treatise on "Sails and Sailmaking," &c., written by Mr. Robert Kipping, N.A., he quotes a letter addressed to him by Mr. W. Edmund Sadler, sailmaker, conveying his opinions as to the way fore and aft sails should be made to secure their standing flat when set.

As it should be the object of every writer, no matter upon what subject to quote as many authorities in relation to that subject as possible, I would beg to call the attention of yachtsmen to Mr. Sadler's views relative to the method of obtaining flat standing sails. I quote some preliminary remarks of his from the above mentioned work.

"I consider the recent device of lacing the mainsail to the boom for flatness, an unnecessary craven giving it up. Let it be flat by cut and make, not by lacing, forcing, and girting. It can be. But I see that the combination of perfect flatness, with a bold roundness of after-leech, generally baffles the skill of the maker. The one is commonly sacrificed to the other. A concave body is obtained by the ordinary method of securing a round leech; and the former is ten times worse than the absence of the latter."

In corroboration of this opinion as to the lacing of sails, I quote an extract from a letter from Lapthorn, of Gosport, one of the best racing sail-makers we have.

*March 28th,* 1856.

"We quite agree with you that all sails should be made to stand as flat as possible, this is what we aim at. We do not hold with sails being laced to the boom for vessels of any size, and unless a vessel has very fine lines, it is a great injury, it does not give sufficient life, which a vessel at all full lined requires."

Long previously to hearing either of the above opinions, I tried lacing the mainsails on the booms of a small racing cutter and a large one; in

perfectly smooth water they went very well, but not so fast as when the lacing was cast off, for the moment we got into a jump of a sea both vessels became as it were bound up and lost speed considerably, which they recovered again the moment the boom lacing was cast off; in both instances we tried the vessels alongside cutters of known speed; they were of modern build and moderately fine lined. With respect to Mr. Sadler's observation as to the rounded after leech, many a time and oft have I heard it made the *sine qua non* when an order was given to sail-makers—without a single allusion being made to the chance of thereby getting a very hollow bodied sail.

In his letter to Mr. Kipping, Mr. Sadler goes on to say

"It is well to be ready to communicate thoughts and information, the result of careful experiments, with a view to attainment of an object of universal desire. Whilst there are some vessels, of different sorts and varying sizes, for which fast sailing is very little or not at all desired, for the great majority of vessels speed is necessary for profit, and in many it is the indisputable condition of their being employed at all. And steersmen experience great pleasure when their vessels acquit themselves properly in sailing.

"To out-distance a fleet of vessels on a course is esteemed a victory. Fast sailing qualities, in most vessels, are of the first importance. As for the others, to talk about smart standing sails for them is a sheer waste of breath. They would not be appreciated. A tarpaulin maker, especially if, by a lean, narrow seamed, shaking foot, and high tack &c., he uses less canvas than others, would most likely prove for such the most acceptable sail-maker. Experience testifies to the corroboration of this remark. For such vessels, ugliness of sails, or want of adaptation to speed is quite out of consideration. To the masters of these dumb dodgers, crab crawling vessels, the all important thing in a sail is—to be able 'to see under it.' This is, however, the exception—the rule holds, nevertheless. Speed is, however, generally desirable, and I have known really fast vessels made slow by bad standing sail, to the intense mortification of their sailing masters. This is well understood amongst cutters and clippers.

"Since the signal victory gained by the yacht America, over the Royal Yacht Squadron, it seems to have burst upon the minds of most nautical men as a discovery that perfect flatness of sails facilitates speed. But by many this has been received as a settled point for the last thirty

years. Whilst going to windward, the amount of canvas occupied by a concave surface, or hollowness in the body of the sail, is equivalent to its total absence—the wind does not act upon it, scarcely touches it. Some have ignorantly supposed a hollow necessary for 'draft,' as they call it, imagining that a plane surface could only propel transversely, or push sideways, but could not possibly send a vessel ahead. But it is easily made to appear otherwise. If one end of the boom was fastened to the stern-post as the other end is to the mast—if, when sailing, the boom did not make an angle with the keel, there would then, indeed, be ground for such supposition. But the boom and keel when sailing always make an angle; and the freer the wind to the desired course, the more obtuse the angle. Thus, then, the boom, always standing off aft, all the pressure received by the sail sends forward the force, and so, of course, propels the vessel ahead. Moreover, hollowness causes the sail often to catch the wind under its lee, sending the boom inwards, but from the direction of the boom it is obvious every such push is a push of the vessel astern. The sum is this;—First, flatness of sail is required, in order that all the canvas in it may do duty, and do it well. And secondly, the angular position of the boom, or 'its standing off' aft, more or less, according to the relative direction of the vessel's course with the wind, directs the entire propulsion forward. Hence, when a vessel receives the wind abeam, she does not proceed in the direction of her beam, viz., sideways, but goes steadily and rapidly ahead. I hope it is sufficiently plain. I offer these remarks on this point—'the necessity of flatness of sail to speed'—as the result of reasoning founded on testimony, observation, and experience. Having thus shown 'why' it is that flatness of sail is found to facilitate speed, I now proceed to set forth the way to make sails stand flat without incurring detriment in other respects. There is a natural tendency in a body of any description of cloth, from a calico bed sheet up to a fore-and-aft mainsail, to describe a concave, or fall into a hollow, when expanded to the wind. This I will suppose to be acknowledged. Well, in a sail, this hollow is proved to be detrimental. Agreed. Well, then, the coast is so far clear. The first problem hence arising is, how safely to proceed to counteract this natural tendency without entailing an opposite evil, as, for instance, a hollow leech—or, in other and plainer words, how to make a well standing and handsome sail of a lithe article called canvas, say a fore-and-aft mainsail. First, the 'cut;'

secondly, the 'creasing of seams'; thirdly, the spreading and creasing of 'tablings'; fourthly, the roping. First, the cut; proceed from the tack. Twenty-two cloths in the sail, six in mast, and sixteen in head, suppose the 'proportion' about the following:—

| Cloths. | Foot-gores. IN. | | Mast-gores. IN. | Head-gores. IN. | Slack. IN. |
|---|---|---|---|---|---|
| 1 | ,, | | 58* | | |
| 2 | ,, | | 48 | | |
| 3 | ,, | | 54 | | |
| 4 | ,, | | 59 | | |
| 5 | ,, | | 59 | | |
| 6 | ,, | | 54 | | |
| 7 | ,, | | ,, | 15½ | |
| 8 | ,, | | ,, | 11 | |
| 9 | ,, | | ,, | 9 | |
| 10 | | | ,, | 8 | |
| 11 | | | ,, | 7 | |
| 12 | As usual | | ,, | 6¾ | |
| 13 | | | ,, | 6½ | 1† |
| 14 | ,, | | ,, | 6 | 1 |
| 15 | ,, | | ,, | 6 | 1 |
| 16 | ,, | | ,, | 6 | 2 |
| 17 | ,, | | ,, | 6 | 2 |
| 18 | 1 | | ,, | 6 | 3 |
| 19 | 2 | | ,, | 6 | 3 |
| 20 | 4 | By Average | ,, | 6 | 5 |
| 21 | 7½ | | ,, | 6 | 8 |
| 22 | 12 | | ,, | 6 | 8 |

"Tack of sail at first setting, when forced down to be only a few inches above the boom, instead of a few feet as usual. Throat at proper place at first; the diagonal stretching at the clew, or boom end, to be provided for 'at the clew,' by cutting up, and not at the throat, as is customary. By providing for the drop of boom by means of keeping down the throat, as the sail stretches down at the boom end it gets hoisted higher at the throat; and so, after the sail has ceased stretching, the tack is many feet above the boom, which is a great waste of space, and gives the vessel the labour of a tall mast for nothing. There are special appliances for hauling up the tack when necessary. Why

* This single gore cut with a round.

† This slack is almost too much at leech for the plan. Rather *under* ½in. per yard of leech cloth, instead of 1in., is the rule for *this* plan; and same for two cloths.

neutralize the use of these, and thereby waste large space, by having the tack, when hauled down to the uttermost, three or four feet, and often more, above the boom?

"SECONDLY.—The 'creasing of seams,' 3ft. 8in. round in foot from tack to sheet.

| Cloths. | Width of Seams at Foot. | Length of taper at Seams at Foot. | |
|---|---|---|---|
| | IN. | FT. | IN. |
| 1 | 2¼ | 2 | 3 |
| 2 | 2¾ | 2 | 9 |
| 3 | 3½ | 3 | 0 |
| 4 | 4 | 4 | 4 |
| 5 | 4¼ | 4 | 6 |
| 6 | 4⅜ | 5 | 0 |
| 7 | 4½ | 5 | 10 |
| 8 | 4⅝ | 6 | 10 |
| 9 | 4¾ | 8 | 4 |
| 10 | 5 | 9 | 4 |
| 11 | 5 (or 4¾ in the maximum.) | 10 | 9 |
| 12 | 5 | 9 | 10 |
| 13 | 5 | 8 | 9 |
| 14 | 5 | 6 | 10 |
| 15 | 5 | 5 | 6 |
| 16 | 5 | 5 | 4 |
| 17 | 5 | 4 | 10 |
| 18 | 4⅝ | 4 | 8 |
| 19 | 4½ | 4 | 6 |
| 20 | 4 | 3 | 10 |
| 21 | 3¼ | 3 | 0 |
| 22 Leech-tabling | | | |

*** Depth of taper and width of seams at foot to be partially regulated by amount of round in foot, which varies. Some would order 5 feet round, and some only 2 feet for this sail.

This style of variation of taper is of vast importance.

These figures merely indicate the principle of the plan.

"Top of first 9 cloths, numbering from tack ¾in. Top of last 12 cloths ½in. 'bare;' the first 9 slightly tapered down a few feet at discretion; the last 12 tapered down about 11ft. or 12ft., to the width of 1¾in. 'full,' and continued exactly this width down to the foot taper. Leech tabling 7in. wide at clew, 12in. wide at extreme peak, and 8in. bare at middle; crease lightly at leech, then spread it carefully, form it with curve exact, and rub it down on floor; when tabled, rub it down briskly like a seam. The curve from clew very sudden, bringing it to 4in.

wide, 3ft. 6in. up from the clew holes, and to 3in. wide 9ft. up. Top of leech tabling gradually tapered down nearly half the length of the leech,—a little sudden at the peak. Thus the head-tabling will cause the leech-tabling at top to clear the leech-seam by the distance of about 2in. The old plan of 'attempting' to form a round leech, partly by wide seams at the head, instead of being a necessary device for counteracting the natural tendency of cloth to belly, greatly adds to that tendency; and, consequently adds nothing to the leech-round. None but a bad reasoner would have hit upon such a method. We all, without thought or question, derived the plan from old custom, and just carried it out as a simple matter of course. The style of taper at foot of seams, here set forth, exactly counteracts a common tendency in mainsails to fall off and shake, describing, by a girt, curve upwards, terminating a little above the sheet and a little above the tack; and when a stunted taper is adopted to prevent the shaking of the foot, the curved falling off of sail from the boom will still appear, forming a deep belly between the foot tabling and centre of the sail.

"THIRDLY.—Spreading and Creasing of Tablings.—Head—sudden curve, downwards at throat, tapered up the head about one-third the length of the head; thence onwards to the peak—the remaining two-thirds 'perfectly straight.' Rather than round it here, as is common, I would hollow it, especially at the peak, this being the lesser of two 'unnecessary evils.' The foot is sufficiently described.—Mast—first, 4ft. 6in., moderate round, to receive the great and sudden girt strain about 3ft. 6in. above the tack; next 12ft., 'very hollow, especially below, graduated above to a straight, and continued straight for several feet last 3ft. 9in. fall in suddenly and much (the upper mast hole 3ft. 3in. down, next one 2ft. 10in., next 2 holes 2ft. 8in., fifth hole, 2ft. 4in., and all the rest below 2ft. apart). Beware of any, the least round at the variation of gore below the throat, the several feet of straight will help.

"FOURTHLY.—Roping.—Mast—first 6ft. slack canvas, rope to receive the force of the bruising down of the tack; all the rest rather slack rope. Head—as much slack in the canvas as the small rope can be made fairly to take (the smaller the rope the greater the susceptibility of stretching), the head rope to be 'rather' tight to the last days of the sail. Leech—slack-rope all the way to first reef, then even 2ft., and then moderate slack canvas to the foot seam—at the clew-holes

canvas extremely slack; there may be six stitches of slack canvas just below the peak cringle, but not more. Foot—slack-rope, about 2in. per 8ft., 'nearly' to the tack—then 'ease' the canvas for 2ft.

"Whilst this proportion of cloth, 6 mast and 16 head, is not uncommon, I judge that 7 by 14 would be very much better. For jibs and forsails precisely the 'same principle' but in less degree. Taper of foot-seams about 2ft. 8in. deep at tack and sheet, and about 4ft, 6in. at middle-seam; some degree of curve in leech tabling, having very sudden round at clew, and some round at head. Also a little taper at top of leech-seam as mainsail. Sudden round on stay to receive the girt strain from clew, thence upwards very slight round to upper stay hole, then fall in rather suddenly at head, especially when there are no stay-holes. Some methods that I have seen for providing for the clew-girt strain are ridiculous; such as, by very long foot taper of tack-seams, and 'hollow leech' at clew; many make no provision for it at all, and the strong girt from sheet to stay forms the appearance of two sails, and is a wretched affair.

"Gaff-topsail, 100 yards of canvas, say; Mast, round about 12ft. or 18ft. up from tack, suddenly upwards; then a sudden 'hollow,' extending about 7ft. up, graduated to a straight, to be continued to the throat.

"The foregoing is not merely intellectual theory and mental speculation, but the result of operative experiments in sail-making, for yachts and smacks 'chiefly,' extending over a period of twenty years; conjoined with observation and reasoning. Not an iota of the methods set forth is unnecessary to the avoidance of defects, or to the obtaining of the desired end. Everything has been long and often tested in connection with high-spirited and fastidious steersmen, to whom a thread awry is an exciting cause of hot indignation. By the above method sails have been pronounced the best standing ever seen; and one vessel in particular, which, though well formed, sailed badly, was through sails so made, said to sail well. This did seem comfirmatory of the correctness of the plan. Moreover, on independent reflection, *a priori*, the plan seems more natural than others. For instance, it appears highly unreasonable to bag a sail by wide seams at head, tapered down narrow and then relieve it by excessive slack in leech cloths. Such wide seams do not round the leech; their effect is consumed in hollowness of the body. The consumption of canvas is about 8 yards per hundred more

than by the old plan; the extra width of foot-seams is partly compensated for by the diminution of the head-seams, as the above shows. By sewing all the 'selvages' together singly, less canvas would doubtless be required than by any existing plan, but it would not answer. Of course if a larger space be covered there must be additional canvas to do it; and so, if you fill up a vacancy at the tack, and have more round in the foot than before, considerably more canvas will be required. This is purely optional, if thereby, 'there be too much sail for the vessel,' shorten your mast and so lighten the lumber; but to waste large space at tack, having pulleys for the special purpose of raising it when necessary, and compensate for the loss by extra length of mast, is seen to be unwise immediately it is pointed out. But, 'without this consideration,' a sail-maker might possibly do a very good thing which an owner might probably deem bad, and positively affirm that the sail was much too large 'in the bill.' As to quantities —3 yards per hundred is the outside of difference, and there it is, doing double duty per shape and substance. I do not believe in terminating leech reef-bands, projecting into the sail some 11ft. or 12ft., the several girt strains commonly miss them; they are generally wholly useless, and sometimes detrimental to the stand of the leech. The quarter of a yard of stout canvas at each leech cringle stuck on the seam, under the lining, is sufficient. A quarter breadth band at the upper reef, extending from the leech-rope to the mast rope, to receive all the upper reef holes, is a very useful addition, but this is extra; so thus the terminating bands are saved. One and a half yards of one-third breadth at mast for strain, and to receive the first reef cringle, is abundant underlining for mast; underlining at the peak is useless; so then much more than three yards of useless canvas is elsewhere saved, but of course where there is no stint, any extras can be used."

I have quoted thus much from Mr. Sadler's letter to Mr. Kipping, as it contains the only opinions from the pen of a practical sail-maker, upon the cutting and making of flat standing fore-and-aft sails, that have come under my observation. In my next chapter I will venture a few remarks relative to the same.

## CHAPTER XI.

"The powerful sails, with steady breezes swelled,
Swift and more swift the yielding bark impelled;
Across her stem the parting waters run,
As clouds, by tempest wafted, pass the sun."—FALCONER.

IN Mr. Kipping's work on Sailmaking, alluded to in my last chapter, Mr. Sadler gives the following dimensions for cutting out a cutter yacht's sails:—

### DIMENSIONS FOR CUTTING OUT FORESAIL.

| | FT. | IN. | |
|---|---|---|---|
| Stay | 35 | 8 | after stretching. |
| Leech | 32 | 0 | " |
| Foot | 16 | 0 | " |

No foot gore, except for round.

| Cloths. | Foot Gores. IN. | Stay Gores. IN. |
|---|---|---|
| 1 | 8 | 63 |
| 2 | 4 | 51 |
| 3 | 2 | 47 |
| 4 | 1 | 46 |
| 5 | 0 | 45 |
| 6 | 1 | 45 |
| 7 | 2 | 44 |
| 8 | 4 | 43 |
| 9 | 8 | 39 |

One 5 feet reef.

### DIMENSIONS FOR CUTTING OUT MAINSAIL.

| | FT. | IN. | |
|---|---|---|---|
| Head | 26 | 0 | equal 13 cloths. |
| Foot | 35 | 0 | equal 18¼ cloths. |
| Leech | 48 | 0 | stretched after the sail is made. |
| Mast | 32 | 0 | ditto ditto. |
| Head Gore | 10 | 9 | |
| Foot Gore | 7 | 3 | |

| Cloths. | Foot Gores. | Mast Gores. | Head Gores | Slack. |
|---|---|---|---|---|
| | In. | In. | In. | In. |
| ¼ | 5 | 30 | | |
| 1 | 15 | 64 | | |
| 2 | 13 | 58 | | |
| 3 | 12 | 66 | | |
| 4 | 11 | 71 | | |
| 5 | 10 | 67 | | |
| 6 | 9 | 0 | 16 | 0 |
| 7 | 8 | 0 | 12 | 0 |
| 8 | 7 | 0 | 10 | 0 |
| 9 | 6 | 0 | 9 | 0 |
| 10 | 5 | 0 | 8 | 1 |
| 11 | 4 | 0 | 8 | 1 |
| 12 | 3 | 0 | 8 | 2 |
| 13 | 2 | 0 | 8 | 3 |
| 14 | 1 | 0 | 8 | 4 |
| 15 | 1 up | 0 | 8 | 5 |
| 16 | 3 | 0 | 8 | 8 |
| 17 | 7 | 0 | 8 | 10 |
| 18 | 12 | 0 | 8 | 10 |

This sail has three reefs 6 feet apart, two with points.

## Dimensions for cutting out Gaff Topsail.

Head .......... 3½ cloths.

| | Ft. | In. | |
|---|---|---|---|
| Foot | 27 | 9 | equal 15 cloths. |
| Leech | 24 | 9 | after stretching. |
| Luff | 33 | 9 | ditto |
| Sheet Gore | 1 | 6 | up |
| Head Gore | 1 | 0 | down at peak. |

| Cloths. | Foot Gores | Luff Gores. | | |
|---|---|---|---|---|
| | In. | Ft. | In. | |
| 1 | 10 | 2 | 11 | |
| 2 | 8 | 2 | 8 | |
| 3 | 6 | 2 | 7 | |
| 4 | 4 | 2 | 2 | |
| 5 | 3 | 2 | 0 | |
| 6 | 2 | 2 | 4 | |
| 7 | 1 | 2 | 6 | |
| 8 | 0 | 2 | 7 | |
| 9 | 1 | 2 | 7 | |
| 10 | 2 | 2 | 7 | |
| 11 | 3 | 2 | 2 | |
| 12 | 5 | 1 | 2 | half cloth. |
| 13 | 8 | — | | |
| 14 | 12 | — | | |
| 15 | 18 | — | | |

The reader, in perusing Mr. Sadler's observations, and noting his

tables of dimensions, must bear in mind the proportionate difference between 24-inch and 18-inch, or narrower canvas.

Mr. Sadler advocates that the tack of a mainsail at its first setting, should be only a few inches above the boom; in the works heretofore published upon sail-making, from 12 to 24 inches, and sometimes more, was the prescribed allowance; however, as these works treat mostly of man-of-war and merchant ships' canvas, and seldom go into the minutiæ of cutting or making yachts' sails, I merely quote such observations and rules from them as bear upon the subject, to draw attention to some points of the system advocated by Mr. Sadler, as well as being the only published authorities yachtsmen at present have to refer to. Any yachtsman of experience will agree that a high tack in a mainsail is bad, to keep the tack well down therefore, and obviate the chance of its being lifted some feet above the boom by the diagonal stretching of the mainsail at the clew, or boom end, Mr. Sadler inculcates that such diagonal stretching should be provided for, not as is customary, by keeping down the throat, but by "cutting or rounding up the clew" of the sail; for if the drop of the boom, consequent upon such stretching, be provided for by keeping down the throat, as the sail stretches and the boom drops, the throat gets lifted and drags the tack up also several feet above where its best efforts are required; for every foot of space that exists between a vessel's deck and the tack of her mainsail, she carries so many useless feet of mast. In point of fact, the vessel's deck is the proper place for the saddle of the boom, and the tack of the mainsail should be boused down to within the depth of the two tack tackle blocks.

With respect to the creasing of the seams of a mainsail, yachtsmen will do well to note accurately the figures given by Mr. Sadler; commencing at the tack, he recommends the first seam to be 2¼in. wide at bottom, thence gradually increasing per cloth up to the 9th, when the seam is to be 4¾in. at bottom; the first seam is to be tapered up the sail from 2ft. 8in. to 1¾in., and thence to the top, tapered to ¾ of an inch: proceeding with the other cloths up to No. 9, he increases the length of the taper of each seam up into the body of the sail in proportion as the width of each at bottom increases, until at No. 9 we find it runs up to 8ft. 4in. when it is gradually decreased, as before, to 1¾in., and thence, like the other preceding cloths, taper to ¾ of an inch to the top of the cloth; at No. 10 cloth the width of the seam at bottom

increases to 5in., the taper upwards increasing to 9ft. 4in., at which distance it decreases to 1¾in., and thence he continues the latter width to within 12ft. of the head of the sail, when he reduces it to ¼in. bare. From No. 10 to No. 17 each cloth is to have 5in. width of seam at bottom, and No. 11 cloth runs to the highest taper in the sail—viz., 10ft. 9in., the remaining cloths are reduced in width of seam and taper of same to the clew of the sail; this style of variation of taper and width of seam involves the most important principle of Mr. Sadler's plan; by it he obtains an inverted curve-girt commencing a little above the tack, rising like an arch into the body of the sail, and terminating a little above the clew; the effect of this inverted curve-girt is to counteract the tendency of the body of the sail to fall off into a bagged or hollow sail instead of a flat one. The next important point he treats of is the forming of a round, and at the same time effective, leech to a mainsail; there are few practical yachtsmen who, during their experience, have not observed a very hollow-bodied sail with a taut after leech; to use a quaint, and at the same time appropriate illustration of such a sail, I shall compare a section of it opposed to the propelling force of the wind to the letter C placed horizontally; the wind first strikes the luff at the head of the C, glances across the body, or bight, and then strikes the tail of the C, where it is caught by this taut leech, which forms a complete back sail, and materially impedes the speed of a vessel; to remedy this injurious effect, and at the same time to preserve a handsome round leech, sailmakers were in the habit of giving wider seams to the head of the sail, in order to round the leech and leave it slack, but in nine cases out of ten the cure was worse than the disease, for the tautness was removed from the extreme leech further into the body of the sail, the bag, or hollow thereof, was considerably increased, and a great slack leech was obtained, which flapped about with a noise like thunder, and though many old salts swore by the shaking leech as humouring the wind out of the sail, the injurious effects existed as heretofore, with the addition of as equally an important defect—viz., the great flapping leech which beat the wind off the after part of the sail, and rendered it comparatively useless; to obtain an easy, flat, and round-shaped leech, that will tremble gently and not flap as the wind leaves the sail, is the desideratum; and this Mr. Sadler proposes to effect, in fact states he has effected, by allowing a certain amount of slack cloth in each of the last ten cloths of the sail, allowing the greatest amount of

slack cloth at the extreme leech, and thence reducing the slack some inches per cloth until the 10th cloth in the body of the sail, where it is only 1in.; this slack to be taken in above the reefs, gathered up, or puckered along the seams evenly; this slack is to be allowed in the cutting out of the after cloths, and when carefully gathered along the seams present a gracefully rounded after-leech, off which the wind glides gently without any hindrance; the hollow body that was created by the wide seams at the head is taken out in conjunction with the graduated seams and taper at the foot of the sail, a hollow spare leech is avoided, and a perfectly flat sail is accomplished.

The spreading and creasing of the tablings of a mainsail is the third part of his system, and is equally important. The young yachtsman may, perhaps, be puzzled as to the exact signification of the technical term "tablings," which I shall endeavour to explain for his information. The "tablings" of a sail are the edges of it turned over and sewed down, so as to form a broad hem; the utility of these tablings is to strengthen the borders of a sail in order to resist the severe strains brought upon different parts of them when it is set, and to these tablings the bolt rope which surrounds a sail is sewn, still further to increase their strength. These tablings should be so spread and creased down on the head, foot, luff, and leech, as most effectually to assist the bolt rope in opposing a successful resistance to any undue strain that might tend to twist the sail out of shape, and at the same time by their strength to stretch the sail flat in every direction without allowing any violent tension to burst the adjacent canvas; there is, therefore, some considerable skill, nicety, and experience required in proportioning them, so as to offer the greatest resistance at such points of the sail as must be hove very taut by the earing, clew, tackle tackle, and nock bolt, in order to secure its being set flat. On this point, therefore, Mr. Sadler's experience offers valuable practical information; he says, that the tabling at the head should be curved down at the throat of the sail, and thence tapered along one-third the length of the head, the remaining two-thirds of the tabling "perfectly straight." The foot should be tabled with the curve decided to be given to it. Mr. Sadler recommends a curve of 3ft. 8in. in depth from the tack to the sheet, from 5ft. to 2ft. range of depth will be ample to suit different tastes, but the depth of the tabling for some yards from both tack and clew, should be tapered slightly to the middle of the sail. The mast tabling, placing of

mast hoops, and tabling of leech he gives ample and clear instructions for. The fourth part of his instructions relate to what may be appropriately termed the "finishing" of a sail, and that is the roping; there is no branch of a sailmaker's business which requires more attention or practical experience, for upon the correct roping depends the setting, standing, and effective properties of a sail. As I have in a former chapter stated, many an exquisitely cut and fashioned sail has been ruined in the roping, and I cannot too strongly impress upon yachtsmen the benefit they will derive from investigating this branch of the subject closely. The best bolt rope is made of fine yarn, spun from Riga rhine hemp, which is the finest, strongest, and most flexible hemp; it is made white, and some sailmakers' tar their own bolt rope, others have it done by some well known ropemaker; it should be stoved by the heat of a flue, and tarred with the very best Stockholm tar; this stoving is for the purpose of rendering the white rope more limber and pliant to receive the tar: the yarns should be hard, but the strands should be moderately closed, so as to preserve the flexibility of the rope: hard closed bolt rope having little flexibility, is not only difficult to sew properly on sails, but does not sit well, and wears short and badly. The following table of bolt rope exhibits the weight per fathom of all sizes from ¾ inch to 8 inch in circumference, the number of yarns in each strand, and the number of threads requisite for sewing the rope on the sails

| Size in In. | No. of Yarns. | Weight per Fathom. lbs. | oz. | No. of threads of twine for sewing them on. Roping twine. | Seaming twine. |
|---|---|---|---|---|---|
| 0¾ | 2 | 0 | 2 | 2 | 0 |
| 1 | 3 | 0 | 3¼ | 2 | 0 |
| 1¼ | 5 | 0 | 5½ | 2 | 0 |
| 1½ | 7 | 0 | 7½ | 2 | 0 |
| 1¾ | 9 | 0 | 10⅓ | 2 | 0 |
| 2 | 11 | 0 | 14 | 2 | 2 |
| 2¼ | 14 | 1 | 1½ | 2 | 2 |
| 2½ | 17 | 1 | 5¼ | 4 | 0 |
| 2¾ | 21 | 1 | 10 | 4 | 0 |
| 3 | 25 | 1 | 15⅜ | 4 | 2 |
| 3¼ | 29 | 2 | 4 | 4 | 2 |
| 3½ | 34 | 2 | 10 | 6 | 0 |
| 3¾ | 39 | 3 | 0¼ | 6 | 0 |
| 4 | 44 | 3 | 7 | 6 | 2 |
| 4¼ | 50 | 3 | 14 | 6 | 2 |
| 4½ | 56 | 4 | 5¾ | 8 | 0 |

| Size in In. | No. of Yarns. | Weight per Fathom. lbs. | oz. | No. of threads of twine for sewing them on. Roping twine. | Seaming twine. |
|---|---|---|---|---|---|
| 4¾ | 62 | 4 | 13¼ | 8 | 0 |
| 5 | 69 | 5 | 6 | 8 | 2 |
| 5¼ | 76 | 5 | 15 | 8 | 2 |
| 5½ | 84 | 6 | 8 | 10 | 0 |
| 5¾ | 91 | 7 | 2 | 10 | 0 |
| 6 | 100 | 7 | 12 | 10 | 2 |
| 6¼ | 108 | 8 | 6½ | 10 | 2 |
| 6½ | 117 | 9 | 1½ | 12 | 0 |
| 6¾ | 126 | 9 | 13 | 12 | 0 |
| 7 | 136 | 10 | 8¾ | 12 | 2 |
| 7¼ | 146 | 11 | 5 | 12 | 2 |
| 7½ | 156 | 12 | 1¾ | 14 | 0 |
| 7¾ | 166 | 13 | 0 | 14 | 0 |
| 8 | 177 | 13 | 12½ | 14 | 2 |

In making sails for Her Majesty's vessels, the twine with which bolt-rope is sewn on is dipped in a composition made with 4lbs. of genuine bees' wax, 5lbs. of tallow, and 1lb. of clear turpentine—all melted together: for merchant vessels' sails roping-twine is dipped in tar softened with oil, which is also used for the seaming twine. In the large sails in Her Majesty's service the twine used for sewing the seams of canvas Nos. 1, 2, 3, and 4 is hand-waxed with a composition made of genuine bees' wax mixed with a sixth part of clear turpentine; for the smaller Nos. of canvas, sewing-twine is dipped in the composition above given for roping twine. In roping a sail the flexibility of bolt-rope should be always remembered when taking up slack cloth; the great difficulty is to rope a sail without getting turns in it; and to avoid this the rope should be kept tightly twisted by the hand whilst sewing on; care must be taken where slack cloth is to be worked up that neither too much nor too little be taken in spots, but that the amount of slack designed be equally taken up in the space indicated; the bolt-rope should be neatly sewn on the sail with the stitches passing through every score of the strands, or as it is technically termed "every contline."

It will be seen that Mr. Sadler recommends the first six feet of the luff of a mainsail from the tack to be roped with slack canvas in order that the bolt-rope may receive the strain exercised in boarding the main tack, and that the remainder of the bolt-rope to the throat or nock of the sail should be sewn on rather slackly. Along the head of the sail, which is roped with a small rope, as much slack canvas as the rope can

fairly be made to take, as the smaller the rope the greater its liability to stretch; the head rope to be "rather" tight to the last days of the sail; the leech to be roped slackly down to the first reef, then two feet to be roped evenly, and moderately slack canvas to be taken up down to the clew, in order to throw the great strain at the clew well on the bolt-rope. The foot to be roped with a slack of two inches per yard of rope for every yard of canvas until approaching the tack, when the canvas should have an easy slack for a couple of feet.

I would strongly recommend any yachtsman desirous of making himself well up in the canvas department, to draught a model sail according to Mr. Sadler's plan, detailed in Chapter X, let it be constructed to a scale of equal parts, whose sub-divisions will admit of conveniently working inches of measurement; then, having made the working draught, let him with pieces of tape, corresponding in width to the scale of cloths, construct the sail; he will get more insight and acquire more information by a little practical handiwork of this kind than can be derived from books alone; it is the same with sails as with a vessel's hull—theory must be reduced to practice.

I append a table of the average circumference, in inches, of bolt-rope in general use for the sails of cutters and boats:—

### Cutter's Rope.

| | Head. | Foot. | Luff. | Leech. |
|---|---|---|---|---|
| Mainsail | 1¾ | 1¾ | 3 | 2 |
| Storm trysail | 2 | 2 | 3 | 3 |
| Topsail | 1½ | 2½ | 2½ | 2½ |
| Save-all-topsail | 1 | 1¾ | 1¾ | 1¾ |
| Square sail | 1½ | 2¼ | 2¼ | 2¼ |
| Gaff topsail | 1 | 1¾ | 2½ | 1¾ |
| Foresail | 0 | 1¾ | 2 | 2 |
| Storm foresail | 0 | 2¼ | 2¼ | 2¼ |
| 1st jib | 0 | 2¼ | 6 | 2 |
| 2nd jib | 0 | 2 | 5½ | 2 |
| 3rd jib | 0 | 2 | 5½ | 2 |
| 4th jib (storm) | 0 | 2 | 4½ | 2 |

### Boat's Rope.

| | | | | |
|---|---|---|---|---|
| Latteen | 0 | 1½ | 1 | 1¼ |
| Settee-sail | 0 | 1½ | 1 | 1½ |
| Lug-sail | 1 | 1¼ | 1½ | 1½ |
| Sprit-sail | 2 | 1¼ | 1¼ | 1¼ |
| Jib | 0 | 1 | 1½ | 1 |
| Foresail | 0 | 1 | 1¾ | 1 |

## CHAPTER XII.

"A sail! a sail!" a promised prize to Hope!
Her nation—flag: how speaks the telescope?
No prize, alas! but yet a welcome sail,
The blood red signal glitters in the gale.—BYRON.

WITH this chapter I give a rough sketch (Plate 42) of a cutter yacht's mainsail, draughted according to the measurements given by Mr. Sadler, which I quoted in Chapter X. It is drawn to scale, and gives the length of head, luff, and foot gores; the width of seams at foot, with the proportionate taper to the top of both mast and head cloths, together with the leech, head, luff, and foot tablings, and the position of the mast hoop holes, reef points, &c.

The measurements to be given for a suit of sails in order to ensure a correct fit, require some attention; the yachtsman will, as a matter of course, have a draught sketch to a scale of equal parts of the hull and spars of his vessel; this draught should be accurately checked with the actual spars given to the vessel (if she is new), as sometimes a sailing master may order a foot or two extra in a boom, gaff, or bowsprit, after the draught has been prepared; and thus a serious error may creep in, if the vessel about to receive a suit of sails has been some years built, actual measurement of the spars is doubly necessary, as some of them may have been carried away and replaced; no dependence should be placed on hear-say lengths of masts, booms, topmasts, gaffs, or bowsprits, as extreme lengths are very often given, instead of from those points that are requisite for the information and guidance of a sailmaker: the experienced yacht skippers well understand these measurements, there are many sailing-masters, however, who do not, but regard the matter as a branch of trade as difficult to master as Sanscrit, and if they are ordered to send the lengths of spars, forthwith take a ball of spunyarn, measure therewith the length of every stick in the ship from end to end, then with a "Gunter's two-foot" make out a very correct looking table of feet and inches, which is forwarded in due course to

the sail maker, the result of which is a tedious correspondence on the part of the latter to get at what he wants, and eventuates perhaps in an indifferent fitting suit, or the trouble and expense of extensive alterations. Let the yachtsman himself take the measuring tape in his hand, together with his note book, and proceed with his skipper to measure the actual spars; or if he has a correct spar draught let him use the scale of parts upon which it is delineated, after the following formula.

### Mainsail.

*Head.*—Measure the gaff from the inside of the jaws, or the eyes of the nock bolt, to the shoulders or stop on the outer end, where the earing of the sail is made fast.

*Foot.*—Measure the boom from the after side of the mast, the inside of the jaws, or the extreme end of the goose neck (should it be fitted with one), to the sheave, or clew lashing eye, at the outer end; state whether the clew is to be made fast with a standing lashing, or to work upon a traveller.

*Luff or Fore-leech.*—Get the gaff hoisted to its proper position, with the peak that the sail is intended to have, and measure from the under part of the jaws of the gaff down to the boom.

*After-leech.*—Let the boom be topped up by the lifts until it stands at the height at the outer end that it is proposed to be carried; steady the gaff amidships with the ensign halliards; then by means of a jewel-block previously lashed at the shoulders or stop on the outer end of the gaff, and through which a light line has been rove; run up your measuring tape by the ring, and measure from the shoulder or stop, to the sheave or clew lashing eye, in the outer end of the boom.

Thus the measurement for the four sides of the sail are obtained, but it cannot be accurately constructed from these alone, a fifth measurement is essential and most important, it is called

*Diagonal or Cross Gore.*—Measure the diagonal length from the throat of the gaff, hoisted as above to its proper height on the mast, to the inside of the sheave or clew lashing eye at the outer end of the boom, the latter topped up, as before stated to its proper position.

Then make a draught of the sail (see Plate 43). Make A B equal to the depth of the luff, say 30ft.: on A B with the length of the boom A S=42ft. 3in., and the length of the diagonal or cross gore B S=48ft., construct the triangle A B S with the length of the gaff B P=31ft., and

the leech P S=47ft. 6in., construct the triangle P B S. Through the points A and B draw the lines A G and B H perpendicular to the leech P S; then G S will be the depth of the foot gore required, and H P the depth of the head gore.

If there should be any rake in the mast the number of inches rake per foot of mast should be stated.

As an additional guide to the sail-maker, it might be useful to state the distance that the upper main sheet block is inside of the sheave, or clew lashing eye on the boom, and thence the height of the boom, when in its proper position, above the deck at that point; some have the boom 5ft. or 6ft. from the deck, so as to clear the head of the man steering in a 50 or 60 ton cutter; others have it lower, of course, as the tonnage decreases, and consequently the hoist of canvas, the boom must be kept lower, but experienced cutter sailors consider an average high clew and low tack a desideratum, as the boom, when the clew of the sail is cut too low, hangs over the lee quarter, when a vessel is close hauled, and tends to make her sluggish in a sea way, and particularly tender if she is lean-quartered; moreover, the strain of the main-sheet towards keeping the sail flat will not be exercised so effectually with a low as with a high clew.

The height of the boom-saddle on the mast above the deck, and the height of the bulwarks, may be mentioned in conjunction with the above, as these will assist in regulating the sweep of the foot of mainsail, which is a very important point to achieve successfully, as nothing can be more unsightly or more injurious to a flat standing sail than too heavy a foot, whereas on the other hand, if it is cut too shallow, a great space is left between the tack and the clew, and much motive power is thereby lost; in a sail the tack of which is kept low and the clew high, the greatest depth of the sweep should be kept nearly two-thirds out in the foot of the sail.

Mainsails are cut out cloth by cloth; a reference to Plate 42 may assist the reader in understanding how this is accomplished; the number of the cloths must be observed. No. 1 being the first cloth next the mast leech, or luff, of the sail, is the first cut, and is thus proceeded with:—the depth of the foot gore=12 inches is measured on the end of the canvas from A to B, it is then carried across a thread of the weft represented by the dotted line C to the opposite side of the selvage at D, and the diagonal D A is cut the length of the tack gore; 58in. is

then measured up the short side on the selvage from D to E, it is then carried across by a thread of the weft marked by the dotted line F to G on the opposite selvage, and the diagonal G D is then cut; then the longest gored side of No. 1 cloth, viz., G A, measures the shortest side of No. 2 cloth; two threads of the weft are again taken across at head and foot, marked by the dotted lines H and I to the opposite selvage of No. 2 cloth at K and L, the mast gore 48in., and foot gore 15in., are then marked off to M and N, and the diagonals M G—N A cut; consequently the first gored cloth, No. 1, being cut, its largest selvage G A serves to measure the shortest selvage, also marked G A of No. 2 cloth, and the longest selvage M N of No. 2 cloth serves to measure the shortest selvage of No. 3 cloth, to which the letters M N are common, and so on the process is continued throughout the mast head and foot gores until the sail is completed, taking care to leave the slack cloth of 1in—1in.—2in., &c., &c., commencing at the 13th cloth in the head, and increasing as per table to the 22nd, or leech cloth, the slack in each cloth to be allowed in cutting out, and to be taken up in the seaming 1in. in every 3ft.; thus No. 13 cloth is taken up in 3ft., No. 16 in 6ft., No. 18 in 9ft., No. 20 in 15ft., and 21 and 22 in 24ft., as marked by the shaded lines on the sail sketch.

Precaution must be taken that the whole of the mast gores exceed not in length the proposed depth of the luff of a mainsail, and it is desirable to measure them carefully over previously, so as to ascertain that they will make that depth before cutting the head gores, notwithstanding the calculation agrees.

In thus cutting out a mainsail, and in fact all sails that are gored on the head, luff and foot, or foot only, and which are designated "fore and aft sails," it must be held in remembrance that a long gore and a short gore are always brought together, and the "breadth" of the "seams" of each cloth "allowed" for eating in seaming.

In cutting out a mainsail from the measurement given of spars, too much attention cannot be paid to the correctness of the lengths given, and then making the proper allowance for the stretching of the sail; if this allowance be not properly proportioned—say at the foot of the sail in the first instance, the chances are the clew hauls out to its berth the moment the sail is bent; likewise if the rake of the mast is not taken into consideration, as to whether it has much or little, this will much effect the depth of the foot gore, the more a mast rakes the less foot

gore will be required; neglect of the precaution to give the rake of the mast and the height of the boom at the outer end or sheet block from the deck, will very probably produce a faulty bodied sail and a slack flapping leech; but if taking the length of the diagonal or cross gore—whereby the depth of the foot gore is determined—be omitted, a bad standing sail is almost certain to result. The allowance for the stretching of a mainsail may be taken as follows:—

*Head.*—To be short of the measurement from the throat of the gaff to the shoulders or stops at the outer end, from 18in. to 2ft.

*Foot.*—In order to provide for the stretching along the foot, and diagonally across the sail, it should be less than the measurement of the boom from the jaws to the sheave, or clew lashing eye, 4in. in every 8ft.

*Luff.*—The luff, or mast-leech of the sail, should be less than the measurement from 12in. to 18in., 12in., or less even if it is intended to board the tack well down.

*Leech.*—From 2ft. to 3ft. may be considered sufficient allowance for the stretching of the after-leech.

### Gaff Topsail.

*Luff.*—Measure from the top of the gaff topsail halliard sheave in the gaff topmast to the throat of the gaff, hoisted to its proper position.

*Foot.*—Measure from the throat of the gaff to the outside of the gaff topsail sheet cheek block sheave at the outer ender of the gaff.

*Head.*—Measure the distance between the head and peak ear-ring holes in the gaff topsail yard.

*Leech.*—Measure with a scale of parts on the draught of this sail the distance between the peak ear-ring hole on the gaff topsail yard, peaked to the proportion designed for the sail to the outside of the gaff topsail sheet cheek block sheave at the outer end of the gaff.

*Diagonal or Cross Gore.*—Measure from the top of the gaff topsail halliard sheave in the topmast to the outside of the gaff topsail sheet cheek block sheath on the outer end of the gaff. This cross gore will answer for the length of the leech of a jib-headed gaff topsail.

Give the diameter of the topsail yard in the slings, the diameter of the topsail halliard sheave, and also the diameter of the gaff topsail sheet sheave.

### Foresail.

*Luff.*—Measure from the hook of the fore-halliard, run chock up in

the fore-halliard block, to the hook of the fore-tack-tackle, hove down to the sheave in the stem-head.

*Foot.*—Measure from the after side of the fore-stay at the stem-head to the fore side of the mast; give the height of the bulwarks abreast of the mast, and also the height of the bowsprit bitts from the deck, so that the foot may not be cut with too much sweep, and thereby foul the top of the bitts, causing injury to the sail, or taking the vessel aback when in stays.

*Leech.*—State whether the sail is to be worked with a horse bolted to the deck or with sheets—if with the former whether its ends are swept abaft the mast, and if so their distance from a straight line chalked across the deck fore-side of the mast; if it is to be worked with sheets state the distance the eye-bolts for the standing blocks are in the deck from the before-mentioned mast-line. The distance from either of these points in a right angle with the fore-stay will denote the effective and proper depth of the leech; it is to be observed that working a foresail with an iron horse on deck is more economical as regards hands, but it is rarely, if ever, such a flat standing or effective sail as when worked with sheets. It should be also stated whether it is meant to work with hanks on the forestay, or with lacing.

*Jib.*—The foot measure from the outside of the sheave at the bowsprit end to the forestay. Give the length of the hook of the traveller, when the latter is run chock out inside from the sheave.

*Luff.*—Measure from the outside of the bowsprit sheave to the jib halliard blocks, and state length of traveller-hook as above.

## CHAPTER XIII.

"How gloriously her gallant course she goes!
Her white wings flying—never from her foes—
She walks the waters like a thing of life.
And seems to dare the elements to strife."—BYRON.

YACHTSMEN will observe that in draughting fore and aft sails, the depths of the gores are obtained as indicated in Plate 43; but there is an addition to these so obtained depths to be made, without which the sail cannot be properly cut out. At page 109, Chap. XII., occurs the passage, "And the breadth of the seams of each cloth allowed for eating in seaming;" to determine then the proper allowance for the breadth of the seam in the cutting out of fore and aft sails constitutes one of the most important details of sail-making; in fact, upon it depends the proper and effective sit of the sail, after all other necessary requirements are complied with. Suppose a sail were cut out cloth by cloth according to the depths of the gores found from a sail draught, without an allowance being previously made for the eating in of the seams, when the sail was sewn together it would not correspond with the draught, and would be found girted from the clew to the throat. In all sails that are cut with a great amount of gore on the luff, head, and foot, such as fore and aft mainsails, or gaff-topsails; or on the luff and foot only as jibs and stay foresails; or any sails or parts of sails that are cut with much gore, it is necessary to have recourse to a graduated table whereby to determine the correct extra lengths to be allowed for eating in of the seams previously to cutting the gores. Such a table forms the basis of the entire system of cutting out sails, and is neither more nor less than a traverse table; and, in fact, when such a table is not at hand, by taking the traverse table of any book on Navigation, making the "depth" of a gore in inches, and the "width" of the canvas (18 or 24 inches, as the case may be) as difference of latitude and departure, the "length" of the gore will be found in the distance column, and in the same page, corresponding to the width of

the seam, in the departure column, the extra length of selvage will be found as difference of latitude.

There is no sail on board a yacht that requires more attention in the construction and making than a jib. If a jib when set does not do its work properly, the vessel is sailing under mainsail and foresail alone, and the tiller does the work the jib should perform, with the addition of rendering the rudder a heavy drag upon the craft. The size of the respective jibs depends much upon the draught of water of a vessel forward; if a vessel draws nearly the same depth of water forward that she does aft, she will take as large a jib as the length of her bowsprit and hoist to the jib-halyard blocks will admit of; that is, when close hauled in a moderately fresh breeze, for a craft with a deep fore foot has generally a tendency to "gripe" or run up into the wind, and in order to counteract this tendency large head-sail must be carried, or else the rudder is brought into play with an effect prejudicial to the attainment of the maximum speed. With a vessel of shallow draught forward the contrary is the case; she will work best with a small, neatly cut jib; this, therefore, should be borne in mind when draughting such sails. In turning to windward a well-cut and standing jib will sit as flat and steady as if carved out of a sheet of ivory, and will take a vessel up to her work three feet to the one a badly cut sail will do; a faulty jib on a wind will exhibit a strong girt across its body, extending from the clew to the luff rope, the result of which will be either a slack drumming after leech, or a loose flapping foot, or both combined; and the wind cannot act upon such a sail with anything approaching to proper effect: to avoid this girt strain, therefore, and to obtain a handsome flat standing effective sail, three things must be borne in mind, inattention to any one of which will ensure faulty results:—

1st—The angle the jib-sheet holes make with the luff rope of the jib.

2nd—That the crown of the roach in the luff of the jib should be exactly opposite the strain upon the clew of the sail.

3rd—That the clew of the sail is never below, and but moderately above a straight line drawn from the jib-sheet hole to the luff rope of the jib.

For the angle which the jib-sheet hole makes with the luff-rope indicates the position and direction of the greatest transverse strain on the sail; and if the roach is not cut upon the sail so that the crown or

centre of it shall meet this strain, the sail will be girted across, and a slack after leech, or flapping foot, or both will be produced; and if the clew be cut so as to hang below this line a slack and drumming leech well be the result, or, if too high above it a flapping and useless foot. Conjointly with these particular points the width and taper of the seams at the foot of the sail, must be proportioned to assist this transverse strain in making the sail to stand perfectly flat, as indicated in Mr. Sadler's plan of the foot seams of a mainsail, for which see Plate 42.

To those who may not be sufficiently versed in technical phraseology, I may explain that term "Roach" indicates an arc or portion of an arc of a circle cut upon the luff of a jib, in order to give a portion of slack cloth to meet the powerful strain exercised by the jib sheet—when the sail is trimmed by the wind: if a jib were cut without the roach (*i.e.* straight by the luff rope), the sail would be girted across from the clew to the luff rope despite of all other precautions, a hollow in the head and foot of the sail would be produced and such a cut jib would be very liable to split in a strong wind, besides being otherwise a faulty and ineffectual sail: this roach, however, must not be overdone, so as to give too much slack, as then the sail would be hollow bodied with a taut after leech and girted foot, and having a tendency to split up from the foot or across the leech, and, like a bellying mainsail, next to useless on a wind. The roach or arc should be sudden, and, as I before stated, immediately opposite the strain from the clew, and should then taper away to the head and the tack of the sail, after the manner of a parabola.

I cannot too strongly impress the necessity of determining the proper position of the jib-sheet holes, and the eye-bolts for the fore-sheet standing blocks: this is a matter too often neglected, and no matter how well jibs and foresails may be cut, unless they can be trimmed at a corresponding effective angle with the mainsail, the vessel is not benefitted by the maximum of their effect, and consequently either much motive power is lost, or the speed of the vessel indirectly retarded; for, should the jib or foresail be trimmed at a more acute angle with the keel of the vessel than the mainsail is, then it acts upon the vessel as if the weather sheet was hauled up and the sail hauled partly to the windward; and if trimmed at a greater angle, a considerable amount of its power is lost.

These are matters that should be carefully attended to during the building of a vessel; or, if not correctly determined at that time, should

be altered when she becomes the property of an owner that knows the difference.

To determine these points, a line should be drawn upon the deck corresponding to the middle of the keel, and the effective angles to be formed by the mainsail, foresail, and jib, laid off from it, the most effective position for leading the fore and jib sheets can be thus very simply ascertained.

## CHAPTER XIV.

"Then on the leeward sheet the seamen bend,
And haul the bowline to the bowsprit line."—FALCONER.

THE ordinary method of constructing jibs is to have the cloths running parallel with the after leech; long custom and the eye being habituated to this mode of construction has probably established a prejudice in its favour. Many attempts have been made to improve upon this construction during recent years, and some with considerable success; the principal of these, and which I have seen tried most successfully in racing yachts is, Mr. Matthew Orr's Angulated Jib. Splendidly working sails, cut and fashioned upon this principle, have come under my observation.

In describing his method, Mr. Orr observes, "Its advantages are, to produce a more favourable effect of the power acting upon the sail than what is produced by the old-established method of construction, and consequently imparting a more advantageous impulse to the vessel."

Orr's jib is a very strong and flat standing sail, when properly constructed, it is also known amongst yachtsmen under the name of the "Scotch-cut jib," probably from the fact of its being principally used by Scotch yachts. For the method of construction, see Plate 44. With the lengths of the three sides of the proposed jib, construct a triangle Z Y X, then make an allowance for the proper roach, or arc on the luff of the sail; this is done by setting off from 2in. to 3in. for every cloth in the sail, at right angles to the straight line Z Y and opposite to the clew, and then describing the roach or arc through its extremity; then taking X as a centre describe the arc A B, and with A and B as centres, describe arcs cutting each other in M; draw the lines X M W, which will bisect the angle X. From W let fall the perpendiculars W E, on Z X and Y X; X E equals the "amount" of the "seam" gores. Divide W E into as many equal parts as there are cloths required to fill up that space, and through the points of division draw lines parallel to Z X and Y X respectively, and meeting in the line W X, from which the

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length of every gore to the scale of dimensions may be accurately found, as the perpendiculars Z C of the small right-angled triangles shown Z C D at the head of the jib in the plate.

Next comes Mr. Andrew Taylor's plan for constructing a jib, in which he gores the after-leech as well as the luff and foot, gets the foot gores more approximating to a thread of the canvas, thereby obviating so much stretching, and reducing the roach on the luff; for it is to be observed that the roach comes in as well to assist the stretching of the sail at foot as to meet the strain from the clew.

This jib stands very flat, and forms a powerful effective sail; to make a draught of this sail, see Plate 45. Take the lengths of the three sides from a scale of equal parts, and describe the triangle Z Y X; give the proper roach or arc to the luff Z Y, and the foot Y X; then take a square A X B, and place the right-angle on X at the clew of the sail; with a pair of dividers take the widths of the cloths that are gored in the after-leech from the same scale of equal parts; put one point of the dividers on Z; move the top of the square until the side A X touches the other point at right angles to it, and mark the point A; then draw lines to the sides of the square, as seen in the plate, and the line Y B drawn from Y at right angles to the side of the square X B, will give the requisite foot gore. Divide Z A and X B (which are equal to the widths of the cloths in the leech and foot) into as many equal parts as there are cloths, and through the points of division draw lines parallel to X A from which the depth of each gore can be accurately found.

Mr. R. Kipping's plan for an improved, or modified Angulated Jib, is a combination of the principles of Orr and Taylor's methods. It differs from Orr's in having the joining seam in the body of the sail, lower down on the luff rope, and more in the direction of the direct strain of the jib; and from Taylor's in having the upper cloths more oblique to the leech, and having much less gore on the luff, Table No. 1, approximating more to a thread of the cloth. It is calculated to make an exceedingly strong, flat standing, and most effective sail, combining the best properties of the other two, with a better distribution of the canvas whereby to ensure equality of stretching all over the sail.

For the mode of constructing this jib see Plate 46: with the length of the three sides, taken from any convenient scale of equal parts, construct the triangle Z Y X, describe the proper roach or curve on the foot Y X and luff Z Y; draw the line X W from the clew to the luff in the

direction of the strain of the jib-sheets; then with any radius X A, describe an arc A B, intersecting X W in M; make M B equal to M A, join X B and produce it to T, and the angle M X B will be equal to the angle M X A, and therefore X W bisects, or equall divides the angle Y X T. From W let fall the perpendiculars W E on X T and X Y respectively; produce W E to any indefinite length, and from Z let fall the perpendicular Z D upon it. Divide W D and W E into as many equal parts as there are cloths required for the leech and W E, and through the points of division draw lines parallel to X T to meet part of the luff Z W, and leech Z X and X W; from the termination of each line, on the line X W, draw parallel lines to X Y. The length of every gore can then be accurately found to the scale of equal parts used. It will be perceived from the plate that the longitudinal threads and seams X T, X W, and X Y, are all well bound to the sheet, thus imparting great strength, and from the direction in which the strain is led from the body of the sail, causes the cloths to stretch in equal proportions every part of it.

Tables I. and II. embody the principles of cutting out all sails in which there is a large amount of gore, such as fore and aft sails; consisting of the mainsails, foresails, jibs, and gaff-topsails, as also storm-trysails for cutters; and the mainsails, foresails, fore-staysails, jibs, flying-jibs, gaff-topsails, main-topmast-staysails, and jib-topsails of schooners; and the yachtsman will find it of material assistance in studying the correct construction of these sails, to make himself intimately acquainted with the principles of these tables. Upon looking at Plate 48, showing the method of obtaining the correct measurements for a yacht's mainsail, the depth of the foot gore is shown by the letters G S; but unless the proper allowance for the eating in of seaming is made in addition to this foot gore, as stated in Chapter XIII., the sail, when put together would be faulty in the extreme. For this purpose, then, these Tables are constructed for 18in. and 24in. wide canvas, and the extra length of seams, according to their width, in the head and foot of sails, to be allowed in addition to the depth of each gore, found upon the sail draught, before the gore is cut, can at once be determined by reference to the Tables.

For example. Suppose the depth down the selvage on any single cloth of 18in. canvas, forming part of a sail, is found on the scale of equal parts to be 8ft., then, in reference to the Table opposite 8ft., in the second column, under the head of "Corresponding length of gore,"

will be found 3ft. 4⅛in. and opposite to this, under the head of "Length of eating in seaming," if the proposed seam be 1in. wide, will be found 2⅛in. to be laid off on the canvas before the gore is marked on the opposite selvage.

In the cutting out of a jib, for instance, beginning at the tack, the width of the seam at foot should be allowed before the gore is cut, and the number of inches to be allowed corresponding with the width of seam, determined upon. Suppose 18in. canvas is used, and that the

### TABLE I.—For Eighteen-Inch Wide Canvas.

| Depth on the Selvage. | | Corresponding Length of Gore. | | Length of the eating-in seaming to be allowed on the Selvage according to the width of seam. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | In. 1 | In. 1¼ | In. 1½ | In. 1¾ | In. 2 | In. 2¼ | In. 2½ | In. 2¾ | In. 3 | In. 3¼ | In. 3½ | In. 3¾ | In. 4 |
| Ft | In. | Ft. | In. | | | | | | | | | | | | | |
| 0 | 1 | 1 | 6 | | | ⅛ | ⅛ | ⅛ | ⅛ | ⅛ | ⅛ | ¼ | ¼ | ¼ | ¼ | ¼ |
| 0 | 2 | 1 | 6⅛ | ⅛ | ⅛ | ¼ | ¼ | ¼ | ¼ | ⅜ | ⅜ | ⅜ | ½ | ½ | ½ | ½ |
| 0 | 3 | 1 | 6¼ | ⅛ | ¼ | ¼ | ¼ | ⅜ | ⅜ | ⅜ | ½ | ⅝ | ⅝ | ¾ | ¾ | ¾ |
| 0 | 4 | 1 | 6⅜ | ¼ | ¼ | ⅜ | ⅜ | ½ | ½ | ⅝ | ⅝ | ¾ | ⅞ | 1 | 1 | 1⅛ |
| 0 | 5 | 1 | 6⅝ | ¼ | ⅜ | ½ | ½ | ⅝ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1¼ | 1⅜ |
| 0 | 6 | 1 | 6⅞ | ⅜ | ⅜ | ½ | ⅝ | ¾ | ⅞ | 1 | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ |
| 0 | 7 | 1 | 7¼ | ⅜ | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ | 1⅞ | 1⅞ |
| 0 | 8 | 1 | 7⅝ | ½ | ½ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1¾ | 1⅞ | 2 | 2¼ |
| 0 | 9 | 1 | 8 | ½ | ⅝ | ¾ | ⅞ | 1⅛ | 1¼ | 1⅜ | 1½ | 1¾ | 2 | 2⅛ | 2¼ | 2½ |
| 0 | 10 | 1 | 8½ | ⅝ | ⅝ | ⅞ | 1 | 1¼ | 1⅜ | 1½ | 1⅝ | 2 | 2⅛ | 2⅜ | 2⅝ | 2¾ |
| 0 | 11 | 1 | 9 | ⅝ | ¾ | 1 | 1⅛ | 1⅜ | 1½ | 1⅝ | 1⅞ | 2⅛ | 2⅜ | 2½ | 2⅞ | 3⅛ |
| 1 | 0 | 1 | 9½ | ⅝ | ⅞ | 1⅛ | 1¼ | 1⅜ | 1⅝ | 1⅞ | 2⅛ | 2⅜ | 2½ | 2⅞ | 3⅛ | 3⅜ |
| 1 | 1 | 1 | 10⅛ | ¾ | 1 | 1⅛ | 1⅜ | 1½ | 1¾ | 2 | 2¼ | 2½ | 2⅞ | 3⅛ | 3⅜ | 3⅝ |
| 1 | 2 | 1 | 10¾ | ¾ | 1 | 1¼ | 1½ | 1⅝ | 2 | 2¼ | 2⅜ | 2¾ | 3 | 3¼ | 3⅝ | 3⅞ |
| 1 | 3 | 1 | 11⅜ | ¾ | 1⅛ | 1⅜ | 1⅝ | 1⅞ | 2⅛ | 2⅜ | 2⅝ | 3 | 3¼ | 3½ | 3⅞ | 4¼ |
| 1 | 4 | 2 | 0 | ⅞ | 1⅛ | 1⅜ | 1¾ | 2 | 2¼ | 2½ | 2¾ | 3⅛ | 3½ | 3⅞ | 4⅛ | 4½ |
| 1 | 5 | 2 | 0⅝ | ⅞ | 1¼ | 1½ | 1¾ | 2⅛ | 2⅜ | 2⅝ | 3 | 3⅜ | 3⅝ | 4 | 4⅜ | 4⅞ |
| 1 | 6 | 2 | 1⅜ | 1 | 1¼ | 1⅝ | 1⅞ | 2¼ | 2½ | 2⅞ | 3⅛ | 3½ | 3⅞ | 4¼ | 4⅝ | 5 |
| 1 | 7 | 2 | 2 | 1 | 1⅜ | 1⅝ | 2 | 2⅜ | 2⅝ | 3 | 3⅜ | 3¾ | 4⅛ | 4½ | 5 | 5⅜ |
| 1 | 8 | 2 | 2¾ | 1 | 1½ | 1¾ | 2⅛ | 2½ | 2¾ | 3⅛ | 3½ | 4 | 4⅜ | 4¾ | 5¼ | 5⅝ |
| 1 | 9 | 2 | 3½ | 1⅛ | 1½ | 1⅞ | 2⅛ | 2⅝ | 2⅞ | 3¼ | 3⅝ | 4⅛ | 4½ | 5 | 5⅜ | 5⅞ |
| 1 | 10 | 2 | 4⅜ | 1⅛ | 1⅝ | 1⅞ | 2¼ | 2¾ | 3 | 3⅜ | 3¾ | 4¼ | 4¾ | 5¼ | 5⅝ | 6⅛ |
| 1 | 11 | 2 | 5⅛ | 1¼ | 1⅝ | 2 | 2⅜ | 2⅞ | 3⅛ | 3½ | 4 | 4½ | 5 | 5½ | 6 | 6½ |
| 2 | 0 | 2 | 5⅞ | 1¼ | 1¾ | 2⅛ | 2½ | 2⅞ | 3¼ | 3¾ | 4¼ | 4¾ | 5¼ | 5¾ | 6¼ | 6¾ |
| 2 | 1 | 2 | 6¾ | 1⅜ | 1¾ | 2¼ | 2⅝ | 3 | 3⅜ | 4 | 4⅜ | 4⅞ | 5⅜ | 6 | 6½ | 7⅛ |
| 2 | 2 | 2 | 7⅝ | 1⅜ | 1⅞ | 2¼ | 2¾ | 3⅛ | 3½ | 4⅛ | 4⅝ | 5 | 5⅝ | 6¼ | 6¾ | 7⅜ |
| 2 | 3 | 2 | 8½ | 1½ | 1⅞ | 2⅜ | 2⅞ | 3¼ | 3¾ | 4¼ | 4¾ | 5¼ | 5⅞ | 6½ | 7 | 7⅝ |
| 2 | 4 | 2 | 9¼ | 1½ | 2 | 2⅜ | 3 | 3⅜ | 3⅞ | 4⅜ | 4⅞ | 5⅜ | 6⅛ | 6⅝ | 7¼ | 8 |
| 2 | 5 | 2 | 10 | 1⅝ | 2⅛ | 2½ | 3⅛ | 3½ | 4 | 4½ | 5⅛ | 5⅝ | 6¼ | 6⅞ | 7½ | 8¼ |
| 2 | 6 | 2 | 10⅞ | 1¾ | 2⅛ | 2⅝ | 3⅛ | 3⅝ | 4⅛ | 4¾ | 5¼ | 5⅞ | 6½ | 7⅛ | 7¾ | 8⅝ |
| 2 | 7 | 2 | 11¾ | 1¾ | 2¼ | 2¾ | 3¼ | 3¾ | 4¼ | 4⅞ | 5⅜ | 6 | 6⅝ | 7⅜ | 8 | 8⅞ |
| 2 | 8 | 3 | 0⅝ | 1⅞ | 2¼ | 2⅞ | 3⅜ | 3⅞ | 4⅜ | 5 | 5⅝ | 6¼ | 7 | 7⅝ | 8¼ | 9⅛ |
| 2 | 9 | 3 | 1½ | 1⅞ | 2⅜ | 3 | 3½ | 4 | 4½ | 5¼ | 5¾ | 6⅜ | 7⅛ | 7⅞ | 8½ | 9¼ |
| 2 | 10 | 3 | 2⅜ | 2 | 2⅜ | 3 | 3⅝ | 4⅛ | 4⅝ | 5⅜ | 5⅞ | 6⅝ | 7⅜ | 8⅛ | 8⅞ | 9⅝ |
| 2 | 11 | 3 | 3¼ | 2 | 2½ | 3⅛ | 3⅝ | 4¼ | 4¾ | 5½ | 6⅛ | 6⅞ | 7½ | 8⅜ | 9⅛ | 9⅞ |
| 3 | 0 | 3 | 4⅛ | 2⅛ | 2⅝ | 3⅛ | 3¾ | 4⅜ | 5 | 5⅝ | 6¼ | 7⅛ | 7¾ | 8⅝ | 9⅜ | 10¼ |

depth of the gore found on the sail draught be 2ft. 5in., and the width of the seam determined as 8in., then in the Table opposite 2ft. 5in. and under 8in. will be found $5\frac{5}{8}$in. to be allowed in the canvas before the gore is cut, as this is the amount that the gore will extend beyond the creasing of the seams.

These Tables will also be found extremely useful in determining the exact length in the luff and leech of a jib, the luff of a mainsail, the luff of a gaff-topsail, as also the length of the leech of a mainsail.

TABLE I.—(Continued.)—For Eighteen-Inch Wide Canvas.

For example. Suppose a jib to be draughted 60ft. on the luff and 86ft. in the leech, to ascertain what it will turn out when made up of 18in. canvas.

Rule six parallel columns, and head them thus: No. of cloths," "Depth of stay gores," "Depth of foot gores," "Length of stay gores," "Length of eating in seaming, viz., 1in. on stay and 3in. on the foot;" number the cloths in this column; find out from the sail draught by the scale of equal parts, the depths of the stay and foot gores (after the

### TABLE II.—For Twenty-four-Inch Wide Canvas.

| Depth on the Selvage. | | Corresponding Length of Gore. | | Length of the eating in seaming to be allowed on the Selvage according to the width of seam. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | In. 1 | In. 1¼ | In. 1½ | In. 1¾ | In. 2 | In. 2¼ | In. 2½ | In. 2¾ | In. 3 | In. 3¼ | In. 3½ | In. 3¾ | In. 4 |
| Ft. | In. | Ft. | In. | | | | | | | | | | | | | |
| 0 | 1 | 2 | 0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ⅛ |
| 0 | 2 | 2 | 0 | ... | ... | ⅛ | ⅛ | ⅛ | ⅛ | ⅛ | ⅛ | ¼ | ¼ | ¼ | ¼ | ⅜ |
| 0 | 3 | 2 | 0⅛ | ⅛ | ⅛ | ⅛ | ⅛ | ¼ | ¼ | ¼ | ¼ | ⅜ | ⅜ | ⅜ | ⅜ | ½ |
| 0 | 4 | 2 | 0¼ | ⅛ | ⅛ | ¼ | ¼ | ¼ | ⅜ | ⅜ | ⅜ | ½ | ½ | ½ | ½ | ⅝ |
| 0 | 5 | 2 | 0⅜ | ⅛ | ¼ | ¼ | ¼ | ⅜ | ⅜ | ½ | ½ | ⅝ | ⅝ | ⅝ | ¾ | ¾ |
| 0 | 6 | 2 | 0½ | ¼ | ¼ | ⅜ | ⅜ | ½ | ½ | ½ | ⅝ | ¾ | ¾ | ⅞ | ⅞ | 1 |
| 0 | 7 | 2 | 0¾ | ¼ | ¼ | ⅜ | ⅜ | ½ | ⅝ | ⅝ | ¾ | ⅞ | ⅞ | 1 | 1 | 1⅛ |
| 0 | 8 | 2 | 1⅛ | ¼ | ⅜ | ½ | ½ | ⅝ | ¾ | ¾ | ⅞ | 1 | 1 | 1⅛ | 1¼ | 1¼ |
| 0 | 9 | 2 | 1½ | ⅜ | ⅜ | ½ | ½ | ¾ | ¾ | ⅞ | 1 | 1⅛ | 1⅛ | 1¼ | 1⅜ | 1½ |
| 0 | 10 | 2 | 1⅞ | ⅜ | ½ | ⅝ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1¼ | 1⅜ | 1½ | 1⅝ |
| 0 | 11 | 2 | 2¼ | ⅜ | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1½ | 1⅝ | 1⅞ |
| 1 | 0 | 2 | 2¾ | ½ | ½ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ | 1¾ | 1⅞ | 2 |
| 1 | 1 | 2 | 3¼ | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1⅝ | 1¾ | 1⅞ | 2 | 2⅛ |
| 1 | 2 | 2 | 3½ | ½ | ⅝ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1¾ | 1⅞ | 2 | 2⅛ | 2¼ |
| 1 | 3 | 2 | 4¼ | ⅝ | ¾ | ⅞ | 1 | 1¼ | 1⅜ | 1½ | 1⅝ | 1⅞ | 2 | 2⅛ | 2¼ | 2½ |
| 1 | 4 | 2 | 4¾ | ⅝ | ¾ | 1 | 1⅛ | 1¼ | 1½ | 1⅝ | 1¾ | 2 | 2⅛ | 2¼ | 2½ | 2⅝ |
| 1 | 5 | 2 | 5¼ | ⅝ | ⅞ | 1 | 1⅛ | 1⅜ | 1½ | 1¾ | 1⅞ | 2⅛ | 2¼ | 2⅜ | 2⅝ | 2¾ |
| 1 | 6 | 2 | 5¾ | ¾ | ⅞ | 1⅛ | 1¼ | 1⅜ | 1⅝ | 1⅞ | 2 | 2¼ | 2½ | 2⅝ | 2¾ | 3 |
| 1 | 7 | 2 | 6¼ | ¾ | 1 | 1⅛ | 1⅜ | 1½ | 1¾ | 2 | 2⅛ | 2⅜ | 2⅝ | 2¾ | 3 | 3⅛ |
| 1 | 8 | 2 | 7 | ¾ | 1 | 1¼ | 1⅜ | 1⅝ | 1⅞ | 2 | 2¼ | 2½ | 2¾ | 3 | 3⅛ | 3¼ |
| 1 | 9 | 2 | 7¾ | ⅞ | 1 | 1¼ | 1½ | 1¾ | 2 | 2⅛ | 2⅜ | 2⅝ | 2⅞ | 3 | 3¼ | 3½ |
| 1 | 10 | 2 | 8½ | ⅞ | 1⅛ | 1⅜ | 1½ | 1¾ | 2 | 2¼ | 2½ | 2¾ | 3 | 3⅛ | 3⅜ | 3⅝ |
| 1 | 11 | 2 | 9¼ | ⅞ | 1⅛ | 1⅜ | 1⅝ | 2 | 2⅛ | 2⅜ | 2⅝ | 2⅞ | 3⅛ | 3⅜ | 3½ | 3¾ |
| 2 | 0 | 2 | 10 | 1 | 1¼ | 1½ | 2¾ | 2 | 2¼ | 2½ | 2¾ | 3 | 3¼ | 3½ | 3¾ | 4 |
| 2 | 1 | 2 | 10¾ | 1 | 1¼ | 1½ | 1¾ | 2 | 2⅜ | 2½ | 2⅞ | 3⅛ | 3⅜ | 3⅝ | 4 | 4⅛ |
| 2 | 2 | 2 | 11½ | 1 | 1¼ | 1⅝ | 1⅞ | 2⅛ | 2⅜ | 2⅝ | 2⅞ | 3¼ | 3½ | 3¾ | 4 | 4¼ |
| 2 | 3 | 3 | 0¼ | 1⅛ | 1⅜ | 1⅝ | 1⅞ | 2¼ | 2½ | 2¾ | 3 | 3⅜ | 3⅝ | 4 | 4⅛ | 4½ |
| 2 | 4 | 3 | 1 | 1⅛ | 1⅜ | 1¾ | 2 | 2¼ | 2⅝ | 2⅞ | 3⅛ | 3½ | 3¾ | 4 | 4⅜ | 4⅝ |
| 2 | 5 | 3 | 1¾ | 1⅛ | 1½ | 1¾ | 2⅛ | 2⅜ | 2⅝ | 3 | 3¼ | 3⅝ | 3⅞ | 4⅛ | 4½ | 4¾ |
| 2 | 6 | 3 | 2½ | 1¼ | 1½ | 1⅞ | 2⅛ | 2⅜ | 2¾ | 3⅛ | 3⅜ | 3¾ | 4 | 4⅜ | 4⅝ | 5 |
| 2 | 7 | 3 | 3¼ | 1¼ | 1⅝ | 1⅞ | 2¼ | 2½ | 2⅞ | 3⅛ | 3½ | 3⅞ | 4⅛ | 4½ | 4¾ | 5⅛ |
| 2 | 8 | 3 | 4⅛ | 1¼ | 1⅝ | 2 | 2¼ | 2½ | 3 | 3¼ | 3⅝ | 4 | 4¼ | 4⅝ | 5 | 5¼ |
| 2 | 9 | 3 | 5 | 1⅜ | 1⅝ | 2 | 2⅜ | 2⅝ | 3 | 3⅜ | 3¾ | 4⅛ | 4⅜ | 4¾ | 5⅛ | 5½ |
| 2 | 10 | 3 | 5⅞ | 1⅜ | 1¾ | 2⅛ | 2⅜ | 2¾ | 3⅛ | 3½ | 3⅞ | 4¼ | 4½ | 4⅞ | 5¼ | 5⅝ |
| 2 | 11 | 3 | 6¾ | 1⅜ | 1¾ | 2⅛ | 2½ | 2⅞ | 3¼ | 3⅝ | 4 | 4⅜ | 4⅝ | 5⅛ | 5⅜ | 5¾ |
| 3 | 0 | 3 | 7⅝ | 1½ | 1⅞ | 2¼ | 2⅝ | 3 | 3⅜ | 3¾ | 4⅛ | 4½ | 4¾ | 5¼ | 5⅝ | 6 |

TABLE II.—(Continued.)—FOR TWENTY-FOUR INCH WIDE CANVAS.

| Depth on the Salvage. Ft | In | Corresponding length of Gore. Ft | In | Length of eating in seaming In. 1 | In. 1¼ |
|---|---|---|---|---|---|
| 3 | 1 | 3 | 8½ | 1⅛ | 1⅞ |
| 3 | 2 | 3 | 9⅝ | 1¼ | 2 |
| 3 | 3 | 3 | 10⅝ | 1⅜ | 2 |
| 3 | 4 | 3 | 11⅝ | 1⅜ | 2 |
| 3 | 5 | 4 | 0 | 1⅜ | 2⅛ |
| 3 | 6 | 4 | 0¾ | 1½ | 2¼ |
| 3 | 7 | 4 | 1¾ | 1⅝ | 2¼ |
| 3 | 8 | 4 | 2⅝ | 1⅝ | 2¼ |
| 3 | 9 | 4 | 3⅝ | 1⅝ | 2⅜ |
| 3 | 10 | 4 | 4⅝ | 1⅝ | 2⅜ |
| 3 | 11 | 4 | 5½ | 1⅞ | 2½ |
| 4 | 0 | 4 | 6½ | 2 | 2½ |
| 4 | 1 | 4 | 7 | 2 | 2½ |
| 4 | 2 | 4 | 7¾ | 2 | 2½ |
| 4 | 3 | 4 | 8¾ | 2⅛ | 2⅝ |
| 4 | 4 | 4 | 9⅝ | 2⅛ | 2⅝ |
| 4 | 5 | 4 | 10⅝ | 2⅛ | 2¾ |
| 4 | 6 | 4 | 11⅝ | 2¼ | 2¾ |
| 4 | 7 | 5 | 0½ | 2¼ | 2¾ |
| 4 | 8 | 5 | 1½ | 2¼ | 2⅞ |
| 4 | 9 | 5 | 2 | 2⅜ | 3 |
| 4 | 10 | 5 | 2¾ | 2⅜ | 3 |
| 4 | 11 | 5 | 3¾ | 2⅜ | 3 |
| 5 | 0 | 5 | 4⅝ | 2½ | 3⅛ |
| 5 | 1 | 5 | 5½ | 2½ | 3⅛ |
| 5 | 2 | 5 | 6½ | 2½ | 3¼ |
| 5 | 3 | 5 | 7½ | 2⅝ | 3¼ |
| 5 | 4 | 5 | 8⅝ | 2⅝ | 3¼ |
| 5 | 5 | 5 | 9 | 2⅝ | 3⅜ |
| 5 | 6 | 5 | 10 | 2¾ | 3⅜ |
| 5 | 7 | 5 | 11 | 2¾ | 3⅜ |
| 5 | 8 | 6 | 0 | 2¾ | 3½ |
| 5 | 9 | 6 | 1 | 2⅞ | 3½ |
| 5 | 10 | 6 | 2 | 2⅞ | 3½ |
| 5 | 11 | 6 | 3 | 2⅞ | 3⅝ |
| 6 | 0 | 6 | 4 | 3 | 3¾ |

| Depth on the Salvage. Ft | In | Corresponding length of Gore. Ft | In | Length of eating in seaming In. 1 | In. 1¼ | In. 1½ |
|---|---|---|---|---|---|---|
| 6 | 1 | 6 | 4½ | 3 | 3¾ | 4½ |
| 6 | 2 | 6 | 5⅜ | 3 | 3¾ | 4½ |
| 6 | 3 | 6 | 6¾ | 3 | 3¾ | 4⅝ |
| 6 | 4 | 6 | 7¼ | 3⅛ | 3⅞ | 4⅝ |
| 6 | 5 | 6 | 8¼ | 3⅛ | 4 | 4¾ |
| 6 | 6 | 6 | 9¼ | 3⅛ | 4 | 4¾ |
| 6 | 7 | 6 | 10¼ | 3¼ | 4 | 4⅞ |
| 6 | 8 | 6 | 11⅛ | 3¼ | 4⅛ | 5 |
| 6 | 9 | 7 | 0⅛ | 3¼ | 4⅛ | 5 |
| 6 | 10 | 7 | 1⅛ | 3⅜ | 4¼ | 5⅛ |
| 6 | 11 | 7 | 2¼ | 3⅜ | 4¼ | 5⅛ |
| 7 | 0 | 7 | 3¼ | 3⅜ | 4¼ | 5¼ |
| 7 | 1 | 7 | 4¼ | 3½ | 4⅜ | 5¼ |
| 7 | 2 | 7 | 5¼ | 3½ | 4⅜ | 5⅜ |
| 7 | 3 | 7 | 6¼ | 3½ | 4⅜ | 5⅜ |
| 7 | 4 | 7 | 7⅛ | 3⅝ | 4½ | 5½ |
| 7 | 5 | 7 | 8⅛ | 3⅝ | 4½ | 5½ |
| 7 | 6 | 7 | 9⅛ | 3⅝ | 4½ | 5⅝ |
| 7 | 7 | 7 | 10 | 3¾ | 4⅝ | 5⅝ |
| 7 | 8 | 7 | 11 | 3¾ | 4⅝ | 5¾ |
| 7 | 9 | 8 | 0 | 3¾ | 4¾ | 5¾ |
| 7 | 10 | 8 | 1 | 3⅞ | 4⅞ | 5⅞ |
| 7 | 11 | 8 | 2 | 3⅞ | 5 | 5⅞ |
| 8 | | | 2⅞ | 4 | 5 | 6 |
| 8 | | | 3⅞ | 4 | 5 | 6 |
| 8 | | | 4¾ | 4 | 5 | 6⅛ |
| 8 | | | 5¾ | 4⅛ | 5⅛ | 6⅛ |
| 8 | | | 6¾ | 4⅛ | 5⅛ | 6¼ |
| 8 | | | 7¾ | 4⅛ | 5⅛ | 6¼ |
| 8 | 6 | 8 | 8¾ | 4¼ | 5¼ | 6⅜ |
| 8 | 7 | 8 | 9¾ | 4¼ | 5¼ | 6⅜ |
| 8 | 8 | 8 | 10⅝ | 4¼ | 5⅜ | 6½ |
| 8 | 9 | 8 | 11⅝ | 4⅜ | 5⅜ | 6½ |
| 8 | 10 | 9 | 0⅝ | 4⅜ | 5½ | 6⅝ |
| 8 | 11 | 9 | 1 | 4⅜ | 5½ | 6⅝ |
| 9 | 0 | 9 | 2½ | 4½ | 5⅝ | 6¾ |

| Depth on the Salvage. Ft | In | Corresponding length of Gore. Ft | In | Length of eating in seaming In. 1 | In. 1¼ |
|---|---|---|---|---|---|
| 9 | 1 | 9 | 3½ | 4⅛ | 5⅛ |
| 9 | 2 | 9 | 4½ | 4⅛ | 5⅛ |
| 9 | 3 | 9 | 5⅜ | 4¼ | 5¼ |
| 9 | 4 | 9 | 6⅜ | 4¼ | 5¼ |
| 9 | 5 | 9 | 7⅜ | 4¼ | 5⅜ |
| 9 | 6 | 9 | 8¼ | 4⅜ | 5⅜ |
| 9 | 7 | 9 | 9¼ | 4⅜ | 6 |
| 9 | 8 | 9 | 10¼ | 4⅜ | 6 |
| 9 | 9 | 9 | 11⅛ | 4½ | 6 |
| 9 | 10 | 10 | 0⅛ | 4½ | 6⅛ |
| 9 | 11 | 10 | 1⅛ | 4⅝ | 6⅛ |
| 10 | 0 | 10 | 2⅛ | 5 | 6¼ |
| 10 | 1 | 10 | 3⅛ | 5 | 6¼ |
| 10 | 2 | 10 | 4⅛ | 5 | 6¼ |
| 10 | 3 | 10 | 5 | 5⅛ | 6⅜ |
| 10 | 4 | 10 | 6 | 5⅛ | 6⅜ |
| 10 | 5 | 10 | 7 | 5⅛ | 6⅜ |
| 10 | 6 | 10 | 8 | 5¼ | 6½ |
| 10 | 7 | 10 | 9 | 5¼ | 6½ |
| 10 | 8 | 10 | 10 | 5¼ | 6½ |
| 10 | 9 | 10 | 11 | 5⅜ | 6⅝ |
| 10 | 10 | 11 | 0 | 5⅜ | 6⅝ |
| 10 | 11 | 11 | 1 | 5⅜ | 6¾ |
| 11 | 0 | 11 | 2 | 5½ | 6¾ |
| 11 | 1 | 11 | 3 | 5½ | 6⅞ |
| 11 | 2 | 11 | 4 | 5½ | 7 |
| 11 | 3 | 11 | 5 | 5⅝ | 7 |
| 11 | 4 | 11 | 6 | 5⅝ | 7 |
| 11 | 5 | 11 | 7 | 5⅝ | 7⅛ |
| 11 | 6 | 11 | 8 | 5¾ | 7⅛ |
| 11 | 7 | 11 | 9 | 5¾ | 7⅛ |
| 11 | 8 | 11 | 10 | 5¾ | 7¼ |
| 11 | 9 | 11 | 11 | 5⅞ | 7¼ |
| 11 | 10 | 12 | 0 | 5⅞ | 7¼ |
| 11 | 11 | 12 | 1 | 5⅞ | 7⅜ |
| 12 | 0 | 12 | 2 | 6 | 7⅜ |

method shown in Plate 42), set them down in their respective columns, opposite each cloth; next find in the Table the length of stay gores and eating in seaming corresponding to the depths found, and set them in their respective columns, then add up the several columns, and proceed as directed by table III.

In precisely the same manner the exact length on the leech and luff of a gaff-topsail may be found. For the luff of a mainsail substract the sum of the eating-in of the seaming from the sum of the "lengths of"

the mast gores, and from which, substracting the number of inches for tabling, the remainder will be the length on the mast. For the leech of a mainsail add the depths of the mast, head, and foot gores, and slack seams together, and deduct from their sum the sum of the eating-in seaming of the mast and foot gores.

TABLE III.

| No. of Cloths. | Depth of Stay Gores | Depth of Foot Gores | Length of Stay Gores | Length of eating in seaming: 1in. on Stay. | Length of eating in seaming: 3in. on Foot. |
|---|---|---|---|---|---|
| | Ft. In. | In. | Ft. In. | In. | |
| 1 | 4 2 | 0 | 4 5 | 3 | 0 |
| 2 | 3 9 | 4 | 4 0⅜ | 2⅝ | ⅛ |
| 3 | 3 4 | 4 | 3 7¾ | 2⅜ | ¼ |
| 4 | 3 0 | 4 | 3 4⅛ | 2⅛ | ¼ |
| 5 | 2 8 | 5 | 3 0⅝ | 1⅞ | ¼ |
| 6 | 2 7 | 6 | 2 11¾ | 1¾ | ⅜ |
| 7 | 2 5 | 6 | 2 10 | 1⅝ | ⅜ |
| 8 | 2 5 | 6 | 2 10 | 1⅝ | ⅜ |
| 9 | 2 2 | 7 | 2 7⅛ | 1⅜ | ⅜ |
| 10 | 2 2 | 7 | 2 7⅛ | 1⅜ | ⅜ |
| 11 | 2 0 | 7 | 2 5⅛ | 1¼ | ½ |
| 12 | 2 0 | 8 | 2 5⅛ | 1¼ | ½ |
| 13 | 2 0 | 9 | 2 5⅞ | 1¼ | ½ |
| 14 | 1 9 | 9 | 2 3⅛ | 1⅛ | ½ |
| 15 | 1 9 | 9 | 2 3⅛ | 1⅛ | ½ |
| 16 | 1 9 | 9 | 2 3⅛ | 1⅛ | ½ |
| 17 | 1 9 | 9 | 2 3⅛ | 1⅛ | ⅝ |
| 18 | 1 9 | 10 | 2 3⅛ | 1⅛ | ⅝ |
| 19 | 1 8 | 10 | 2 2⅞ | 1 | ⅝ |
| 20 | 1 8 | 11 | 2 2⅞ | 1 | ⅝ |
| 21 | 1 8 | 12 | 2 2⅞ | 1 | ⅝ |
| 22 | 1 8 | 12 | 2 2¾ | 1 | ⅝ |

| | | | | | |
|---|---|---|---|---|---|
| | 50 1 | 13 8 | 60 2⅞ | 2 9⅛ | 9⅜ |
| Deduct seaming on stay & foot | 2 9⅛ | 9⅜ | 2 9⅛ | | |
| | 47 3⅞ | 12 10⅝ | 57 5¾ | | |
| Deduct depth of foot gores | 12 10⅝ | | 9 | Deduct for tabling | |
| | 34 5¼ | | 56 8¾ | Length of luff tabled | |
| Deduct for tabling | 9 | | | | |
| Length of leech tabled | 33 8¼ | | | | |

## CHAPTER XV.

"Oh! who can tell, save he whose heart hath tried,
And danced in triumph o'er the waters wide,
The exulting sense—the pulse's maddening play,
That thrills the wanderer of that trackless way!"—BYRON.

WE will assume that a yachtsman has had a vessel built by one of the best builders of the day—a man of high reputation and practical skill; that she has been modelled according to the most approved and correct principles for ensuring an able, comfortable, and fast vessel; put together in a style of workmanship, and with materials calculated to ensure strength, permanence of form, and durability; that she has been coppered with the best material and in the most skilful manner; launched successfully; sparred with the finest sticks that money could procure; rigged in a manner and with such manufactured materials as to defy criticism; a suit of sails bent that place the most fastidious connoisseur at fault; her internal fittings a marvel; her boats faultless; she is under the command of a sailing master possessed of all the requisite acquirements, having a name amongst his fellows for skill, seamanship, and daring; is manned by a splendid crew of picked yacht sailors; and, in fact, money has been expended with a lavish hand in order to insure success. The yachtsman takes two or three cruises in her, and is delighted; she is everything he wishes for; all bills are discharged; she is his own, clear of builders and riggers, and he pronounces her "a success." Well, he goes a fourth cruise, and it is discovered that she gripes a little, and her skipper recommends that her fore-foot shall be rounded off a bit; so she is hauled up on the builder's slip again, and the necessary alterations made. It don't do, however; the next cruise her windward tendency is as strongly developed, and the captain declares his arm is nearly torn from the socket with the weather helm she carries; it is a good fault, though, he asserts, and a little further alteration will remedy it; she must have a longer bowsprit, that's all! So in she goes for a new bowsprit five or six feet longer than the

former one. Out she cruises again, and this time she is nearer the thing, but the jibs are too small for the new bowsprit; the sailmaker is consulted, and the pros and cons of an additional cloth or two discussed and agreed to. Then it occurs to the skipper that the clews will be too high, or the sails will look patched, which would never do for a fine new vessel, and the yachtsman pooh-poohs the idea of patched or ill-looking sails; so new jibs are ordered forthwith.

Her next trial is in smooth water with a gentle breeze, and she does nicely; all is now declared right. Some days after she goes out for a sail, and falls in with a fresh breeze; her skipper keeps her going at it close hauled, in order to exhibit her good qualities to her owner, when, to the surprise of both, she buries her head bodily in the sea, and gives her crew a pretty considerable dose of green water fore and aft; but her astute commander declares it to be nothing of consequence, although he hears the crew pretty audibly anathematizing the blessed "hooker," shrugs his shoulders, gazes aloft and alow, puts on his wisest look, and says he will make it all right when he gets back to moorings—"she is only a 'leetle' by the head, that's all!"

So accordingly next day, at moorings, the cabin platforms are taken up; the ballast which the builder very properly concentrated as much as possible, is re-stowed and spread well aft under the ladies' saloon, so as to bring her by the stern and lift her bows out of the water; this does very well in cruising for the next day or two; the owner thinks he has got a deuced smart, clever skipper, and accordingly determines to have a run to Cherbourg, or some other foreign port, now that he is all to rights, and determines to be back just in time for the regatta, and perhaps his maiden cup. The morning is fine, with a fair wind; the new clipper slips away at a grand speed; "reeling twelve of 'em off if she's sailing an inch!" exclaims the skipper. "We'll show some of them the way when we get back, I'll warrant!" ejaculates the mate. "Go it, my little beauty!" "A splendid vessel indeed, my dear Robinson!" chime in two or three friends, who make the cruise enjoyable, and Robinson makes it twelve o'clock. The steward comes up in his neatest attire; the slender-stemmed crystal goblets are filled to the brim, and success, and no end of cups, are voted to the gallant Robinson and his beautiful yacht, the Merrythought. The day thus passes merrily away, night approaches, looking fine, and with a rattling breeze; as it increases, murky-looking clouds make their appearance,

and the wind heads her a bit, but she can just lie her course, and as she is within a few hours' sail of her port, it is not worth while reefing; added to which Captain Burlybounce is rather glad on the whole to have an opportunity of showing the gentlemen what she can do, and how well he can handle her:—now the weight of the squall is upon her, he won't luff—not he! over she goes at an angle that rather astonishes the gentlemen, and compels them to hold on, with the tenacity of grim death, to the weather bulwarks:—"'Tis a jolly breeze—worth going a thousand miles to enjoy!" is the chorus. Now comes another squall heavier than the previous one; over she goes again until her lee side is buried up to the skylight coaming; the boiling surf covers her decks, banging amongst the spare spars, tumbling over the skylights, popping sportively in gallons down the companion, floating the coiled falls about, and damping all hands pretty considerably. "Don't you think, Burlybounce——" faintly ejaculates her owner, but what he would suggest sticks in his throat, for just at that moment Burlybounce finds her running off her helm in the most unaccountable manner, and sings out lustily to "Let go the fore halliards, and stand by the jib sheets!" and round accordingly she comes. The gig has been stowed on the side she was weak on, and the skipper determines to try her on the other tack until the squall ceases a little. His mainsail is new, and he does not like to reef it, and—and—he does not like that running off the helm, that's a fact. What a mess he would be in if he got inshore and she would not work with him; so he says he'll work her to windward of the harbour a bit to make sure of it, as the night is getting dark; but lo! the other tack is no better,—lee helm she must have to keep her on her course, and lee helm accordingly her puzzled skipper gives her, although with a sadly troubled spirit.

The weather has now become settled down for a blow, and the wind drawing is dead off the land too, so Burlybounce and his mate hold whispered hurried conference accompanied by many shakes of the head and winks of the eye, and it is resolved to make the Merrythought snug for the night, "for it looks uncommon dirty up to wind'ard, sir!" The owner and his friends, therefore, betake themselves to the cabin and the care of the steward (unless they happen to be what they ought, regular hard-weather, rough-and-take-it yachtsman), when all is right on deck, and the vessel underway again, the skipper descends to the cabin, where he finds his master, with his feet against the lee sofa, and his shoulders

against the weather one, in as nearly a perpendicular position as possible. One friend, in endeavouring to establish himself securely, has grasped at the swinging table, whence—oh! frail support!—he finds himself on the top of his head in the steward's pantry. The second has torn away the berth rails in the ladies' saloon in frantic attempts to steady himself, and another makes himself comfortable on the state cabin platform, amongst carpet bags, boots, and the *debris* of a wash-hand basin; chaos on the deck, chaos below, the wild wind whistling and howling dismally, the sea swashing mournfully about the vessel's sides, and breaking, with heavy monotonous "thuds," against her bows and upon the deck; the crew hurrying to and fro, now a heavy jumping overhead, then a pause, a rattle of gear, and two or three blocks come down with a bang that make the teeth of those below chatter again; then there is a hoarse order from the mate, who is at the tiller, to "trice up the main tack well, and lower that 'ere for'sail again!" The skipper has been meanwhile framing a nice little speech, but does not know rightly how to begin it, until the last order of the mate wakes him up sharp,—"Please, sir, I think we had better run her off the land; I don't half like the look o' things, and with all our new gear, and ropes not running freely through the blocks, and one thing or another we might get into a difficult mess yonder."

"Well, Burlybounce, you know best, of course—but what do you think of our getting back to Cowes!"

"Well, sir—I think it's the very best thing we could do; we've a fair wind back, and it's ugly work about this French coast here if you're not used to it!"

Away bounds Burlybounce; two springs and he's on deck, where, in sonorous tones, resound the orders, "Out main sheet—up helm!" In a moment she is upright,—so Robinson assumes the attitude nature designed for man; friends one, two, and three crawl out of their retreats; the steward comes grinning in like a well-fee'd family physician, and prescribes a mild course of *Vieux Cogniac* with *Aqua fervefacta*, which his patients undergo with singular resignation, gravely assuring them at the same time "that, during twenty years' experience at sea, he has always found some sort of weather this time o' year!"

But if ever Burlybounce had a trial of his powers as a helmsman it is now that she is before the wind; she yaws about after a fashion, that makes all hands stare; now she takes a range, and threatens to come

up to wind in spite of him, then she falls off again with a sweep that bids fair to jibe the mainsail; she is more by the head than ever, whilst her stern is up in the elements, and the mate scratches his head in puzzled perplexity, and vows she "pawls him!" Next morning safe and sound at moorings again, the skipper and all hands have hit it this time; it's all in her mast; "they said so from the first day they sailed in her; her mast must be shifted!" Accordingly, into the builder's hands she goes again; "there is just time to do it before the regatta, and with this alteration there won't be a finer vessel afloat; besides, it's a common thing with yachts; scarcely one ever was built that hadn't her mast shifted after she was sailed a bit!" Poor Robinson looks cheerful, supposes it's all correct, and strives to hope that he'll be the crack boat of the season after all.

The eventful day of the regatta arrives, and the Merrythought, under a mountain of canvas, is the cynosure of all eyes—"The new yacht! the new yacht!" echoes around. "I know Robinson; capital fellow and a thorough yachtsman—the other fellows haven't a chance with him—she's a splendid vessel, swift as the wind—cost him £3,000—she must win!"

The starting gun is fired; away go the fleet of racers, but the Merrythought will not "come to the front;" on the contrary, she exhibits rather a modest, retiring tendency, and falls bashfully astern: another half hour, and she evinces a desire for solitude, giving at the same time evident symptoms of a weak constitution, for, whenever a stronger blast than usual strikes her as she is closed-hauled, she yields to it without a struggle, and when down remains there for a moment or two as if to regain her strngth. Eventually the race terminates with the victory of a veteran, and the Secretary's list has upon it, opposite the name of the Merrythought, John Robinson, Esq.—not timed. Next day J. Robinson, Esq., is convinced, by unmistakable demonstrations, that his vessel has not only been over sparred and over canvassed, but that her mast has never been in the right place at all.

Now, good reader, you may probably exclaim, "What is the use of telling us all this about what must have been a very bad vessel?" On the contrary, a very excellent good vessel, I do assure you. I do not for one moment mean to say that, as a general rule, vessels at the outset behave in the manner I have endeavoured to describe; this would be doing a very great injustice to our excellent yacht builders indeed; but

that many instances do occur I am perfectly aware, and that yachtsmen are sadly hampered and annoyed, when by a little application on their own part they might be enabled to secure at the commencement comparative impunity from a source of annoyance that has often driven good men off the water.

I have assumed in the imaginary case just stated that a yachtsman has gone to an excellent builder, given him *carte blanche* to build him a vessel as soon as possible, as he wants her for the ensuing season. The builder's yard is full of work; the order was given in a hurry, and must be done in a hurry, for the money is waiting; so he gets her from the builder in a hurry, steps on board in a hurry, and don't bother his head further; and if she does turn out as I have stated he may thank himself entirely for it. If he does not take the trouble of investigating the working drawings of the vessel before ever a chip is splintered, and goes through them carefully, seeking for full explanations on every point that he does not understand most clearly, the chances are that he may get a very fair vessel—perhaps a very bad one, but most certainly he will rarely get a brilliantly successful vessel unless he evinces his interest in such success, by close application, to every detail calculated to ensure it. By working drawings, I mean somewhat more than the mere stereotyped set of half-breadth, sheer, and body plan affairs, indifferently designed and as badly executed, which some artificers delude their victims with; or the wonderful models carved out of a solid block, which profess to be correct delineations of what the sculptor appears to be incapable of putting upon paper. The various requirements that a really good vessel has to fulfil cannot be dashed off in half-a-dozen strokes on a sheet of double elephant; neither can the butt end of a kindly grained pine log be converted with chisel and sand paper into a model that shall combine all the properties that salt water likes, merely from intuition of the eye alone. There are certain mathematical and geometrical principles that must be deferred to, and which, if neglected, will as certainly ensure failure.

There is no more fertile source of disappointment in the success of a vessel than the misplacement of her mast or masts; I have endeavoured in recent chapters to draw attention to the fashioning of sails, and in connection with that subject I will endeavour to arouse equal attention to the no less important detail of the stepping of masts;—for I believe at the present time that more of the disappointments connected with good

looking and well-built vessels, may be, and are, traceable to the want of studied detail in the placing of and proper length of the spars, and the consequent regulation of the spread of canvas. It is a common thing to hear sailing masters of yachts exclaim, whilst a vessel is on the stocks, "Oh, sir, don't cripple her in spars and canvas; we'll make her carry them, never fear."

Many a good little barque has been ruined by this very system of not "crippling" them in spars and canvas; for between overwhelming spars, clouds of canvas, and tons of lead, the only wonder is that they were able to live through a cruise or race at all. I am certainly not an advocate for restricting a vessel through any craven idea of danger, but there is a bound which, once overstepped, violates the principles of science and the experience of practice.

The Vanguard, when she first made her appearance, did nothing in comparison to what she has done since her mast has been reduced; on the other hand, the Mosquito has been improved by more canvas, so that where one vessel must have her spars reduced to make her up to the mark, another may be obliged to have hers lengthened; and thus it is shown that what is really required is to have a proper balance of carrying and driving power.

The subject of flat standing sails has been so frequently discussed, that I trust my renewing it will not be deemed a tedious repetition: the question as to the proper stepping of masts is one that I consider has been too much neglected or made quite a matter for secondary consideration: how often do we see a vessel built and her deck laid before a word is spoken about a sail draught? Now a correct sail draught has more to do with the masting of a vessel than many people are willing to admit; and why will they not admit it? Because, unfortunately, we are some of us great sticklers for that noble science called the "rule of thumb," and because vessels with bluff bows and their masts stepped according to that rule, and did well, all vessels built according to modern rules must necessarily be masted so likewise. It is all very well to take for example a vessel of equal or nearly equal size, and similar lines, and that has been found of superior performance, and mast, according to her proportions; but to make it a general rule for all, irrespective of difference of form is absurd. The centre of effort of the sails, taken in relation to the centre of displacement, centre of gravity, and centre of longitudinal section, should be the principal guide to the correct position and proper dimensions of a vessel's spars.

## CHAPTER XVI.

"High on the slippery masts the yards ascend,
And far abroad the canvas wings ascend;
Along the glassy plain the vessel glides,
While azure radiance trembles on her sides."—FALCONER.

THE yachtsman who will give a little careful consideration to the subject of masting, cannot fail to perceive the immense influence the proper disposition of the mast or masts must exercise upon the performances of a vessel; upon the first trials of a yacht are based the opinions as to whether she is fast and weatherly, and very oftentimes I fear a goodly little ship has fared ill at the hands of her critics, from the misplacement of her crop of sticks; it would be very interesting to know how many vessels have been tried, and altered, and re-tried and altered again; and of these how many have had proper and correct draughts on board showing their centres of buoyancy, of lateral resistance, and the effort of their sails. How often do we see and hear of these alterations being made in a new vessel, and are such points as the above ever mentioned in relation to such alterations? Which of us have not watched with eager anticipation the fiat of some first rate judge of the good points of a yacht, and regarded him in the light of a sage as he gravely shook his head and pronounced, "Her mast must be shifted!"—not one word more—that is quite enough for some of us without seeking any further information on the subject: we won't oftentimes take the trouble of asking ourselves a simple question—"the reason why!" It is assumed that our friend A, who has been yachting all his life, cannot err,—he has been on board the yacht whilst under way, has steered her, pronounced his opinion, and he cannot be wrong; friend B, another excellent yachtsman, comes after A, hears the opinion formed, has an experimental cruise, and thinks with A, too; "certainly shifting the mast would improve her!" Two good judges having thus pronounced that the position of the mast is the seat of error, it is shifted accordingly at hap-hazard; now, is there the slightest probability of its having been

done so with advantage? by the merest chance the happy medium may be hit upon, but the chances are 10 to 1 against it.

What after all if the masting have nothing whatever to do with the faults complained of? but no—this could not be, for both A and B concur in opinion that it can only be the mast.

Now, if the reader will refer back to Plate 5, Chapter IV., he will find there one of the most fertile sources that can exist for causing a vessel to steer and perform badly; in this plate diagrams are given of two vessels, one with flaring quarters, the other with her quarters neatly rounded up; here, therefore, we have an example of what is technically called "the inequality of the lines of immersion and emersion;" which simply is that the lines of the quarter above water do not harmonize with those beneath, and that when the vessel careens to a strong breeze a greatly increased water line, called the "Inclined Water Line," is submerged, and this being fuller than it should be at the quarters of the vessel, creates a huge wave; this wave being carried along with the vessel causes a drag upon the quarter under which it appears, just as if a hawser or a chain cable was towing overboard from it; in consequence of this drag aft the vessel requires lee helm according as the inclines, but immediately that the pressure of the wind ceases, so as to allow her to sail at a less inclination, and thus lift this faulty water line out of the way of doing harm, she again gives wholesome obedience to the tiller, and the faulty performance resultant upon an error in the construction of the hull is very apt wrongly to be attributed to the spars.

Of all the difficulties that beset a yachtsman's path, perhaps there is none more bewildering than the system, or rather systems, of placing a yacht's spars; almost every builder has a theory of his own upon the subject, either adopted partly from some existing system, and modified according to circumstances; or else a combination of systems such as may suit his ideas, but perhaps have no relation whatever to the form of the yacht to which they may be applied. In this way is much mystery engendered and perpetuated, and in fact it may be said that this mystery is not confined to the question of spars alone, but casts its bareful cloud over many other matters connected with yacht building and sailing: a mystery which can only exist from motives of self-interest in some cases, in others from sheer ignorance, and in many from a dogged resolution of following old custom, and a reckless determination to ignore all improvements.

In the state of transition which the science of Yacht Building has of late years been, and may be said still to be in, this mystery of sparring has been disporting itself most fantastically; we have seen vessels with knife-like entrances sparred apparently without the slightest regard being had to the sweeping alteration that modern improvements have effected in the shape of the hull; the old "cod's head and mackerel's tail stern" did well with sticks so placed, and accordingly when both ends of the ship became revolutionized in shape, and the "mackerel's tail and cod's head" had changed places, masts were stepped as of old, without any reference to the totally different circumstances under which the modernized hull met with and overcame the resistance of the water. Masts were placed in sharp ships where there was no hull to support them, and good wholesome vessels received the name of wet, dangerous boats, solely from the fact that in our eagerness to embrace the novelty, we took neither the care nor trouble to become acquainted with its principles and peculiarities. It is in respect to this I think our builders and yachtsmen have been steering remarkably wild, and that instead of looking in the proper place for the failures that we complain of, we have attributed them to causes that have led us still further into error, and possibly useless expense, without the most remote probability of even blundering on ultimate success.

Would a man who had to carry a heavy weight for a considerable distance sling it at the further end of a stick placed across his shoulder and then hope to husband his bodily strength for surmounting the inequalities of his path, and at the same time enable him to accomplish his journey with the greatest possible speed? And yet this is what is practically done in the sparring of many vessels. It may be said that there is no analogy between the movements of a laden man on land and those of a vessel in the water, but if the burthen on the man's back is not so placed as to enable him to carry it to the best advantage without crippling his powers of travelling with ease to himself, he won't travel at all; and if the vessel is not enabled to meet and overcome the resistance of the water, which impedes her progress, without being dragged one way by her canvas and another way by her rudder, neither will she travel either; at least so as to realize the hopes of her constructors.

In order to arrive at a correct understanding of the object we are desirous of accomplishing—viz., the most effective system of placing a vessel's mast or masts, so that the canvas set thereupon may propel her

at the greatest attainable speed, and to the best advantage under all circumstances of wind and weather, it is necessary that two or three particulars points should be kept prominently in view,—with regard to the canvas and with regard to the hull: first then let us remember that every sail, no matter what size or shape it may be, when acted upon by the wind, has its "centre of effort;" or, as a distinguished writer on naval architecture more correctly defines it, "centre of propulsion." To use a homely, and I trust not inapt illustration of this centre of propulsion, I may assume that many of us have not forgotten the pastimes of our boyhood, and amongst them that of sending up mimic balloons made with a square of silver paper, having threads brought from each of its corners to a centre, suspended from which was a cork attached to a single thread, by way of a body to be carried by our ærial craft. Now that single thread represented the centre of propulsion of that sheet of silver paper, and the cork the hull of our vessel: or, in other words, the power of the wind exercised all over the whole sheet became, so to speak, concentrated at this point, and thus carried our cork away.

Thus it is also with the sails of a vessel, no matter how they are spread to the wind, each and every one has its centre of propulsion, but unlike the balloon, each has not its special cork; there is a common cork for them all to tug at, and this common cork is the hull of the little ship; this common cork therefore involves a common centre of propulsion, so that no matter what may be the number or locality of a vessel's sails, there is one common centre, at which all their efforts are united, and this is called, *par excellence*, THE centre of propulsion, or centre of effort of the sails.

Secondly, with regard to the hull,—every vessel modelled for high speed, has as small direct, and as large lateral displacement, as is consistent with stability and the requisite draught of water fore and aft. When this vessel, therefore, is close-hauled upon a wind, the water resists her large lateral displacement, and prevents her drifting in the direction the wind blows, and her direct displacement in the direction of her keel being comparatively so small she glides ahead at an acute angle with the wind, and this constitutes her weatherly ability, or power of sailing near to the wind; the possession of which in a large degree constitutes the best quality of a vessel.

I use the term lateral displacement in a relative, and not in a positive

sense, as displacement implies the cubic space occupied by the hull in length as well as in breadth, but I think it is a more appropriate term than "lateral resistance," as in reality it is not the vessel that resists progress in the direction that the wind is blowing, but the water, which acts as a wall of fluid, if I may so term it, under her lee, and will not allow the passage of so large a surface in that direction, but drives her across it transversely in the direction of her least displacement—viz., that of her midship section. To familiarly bring home to our mind the effect which this wall of water has in driving a vessel to windward, let us take the blade of a knife or the blade of an oar, and endeavour to drive it through water with its greatest surface presented to the action of the water, it will be found that the water will pile up and resist it in a most remarkable way, and that no matter how firmly we hold the knife or the oar, it will have a tendency to fly to the right or to the left, in the direction of its least displacement, that of the edge.

Now this lateral displacement of a vessel has in relation to the power of the water a common centre, similar to that of the sail acted upon by the wind, and this centre is called the centre of lateral resistance, or to use my term, the centre of lateral displacement, and here then are two principal points in the sails and the hull, to which I would beg to draw earnest attention. On the centre of lateral displacement a vessel oscillates laterally just as the beam of a scale oscillates on its fulcrum: when she is close-hauled, and the sails so distributed that precisely the same amount of their effort may be exercised forward of this point as aft, then the centre of propulsion of the canvas coincides with the centre of lateral displacement of the hull, a harmonious combination is effected, and the best efforts of both are directed to a common object—that of sending the vessel ahead with the greatest speed, and the utmost powers of both are concentrated; but if on the other hand the centre of propulsion and the centre of lateral displacement do not coincide, then the former must be either forward or aft of the latter; if it is forward the head of the vessel is forced to leeward, and she will require a lee helm to make her go in the direction she ought, and consequently propelling power is lost, her speed retarded by the rudder, and she will have a strong tendency to drift to leeward; if it is aft she will require heavy weather helm to keep her likewise on her proper course, and prevent her griping or eating into the wind; and in this case it is a contest between the rudder and the canvas to see

which will obtain the mastery; the result of which is that her speed is materially interfered with, that the canvas is a strain upon her, the rudder a drag, and she is altogether astray.

But there is a third point still, yet which is as equally important as the other two, and involves the most vital quality of a good vessel, namely, her stability. This is the height of the centre of propulsion of the sails above the Load Water Line of the vessel. This brings the consideration of the other points of sailing—viz., "free, and with the wind aft," before us. It will be well, therefore, to bear in mind that as well as finding the longitudinal position of the centre of propulsion of all the sails, we have at the same time to determine the height of that point above the Load Water Line.

As a vessel oscillates laterally upon her centre of lateral displacement so also does she oscillate longitudinally upon her centre of gravity of displacement; now the centre of gravity of displacement must be properly understood, for many scanning the term might be disposed to consider that this centre and the centre of gravity of the vessel is one and the same; on the contrary, they are widely different, the centre of gravity of a vessel is the centre where the weight of her hull, spars, rigging, and sails are concentrated, and may be called the centre of absolute gravity; but the centre of gravity of displacement is the centre of that body of water which is displaced by the hull of the vessel from her Load Water Line downwards. The centre of absolute gravity tends to push a vessel down in the water, and the centre of gravity of displacement to push her up, and this property of the latter acts at the point called the Meta Centre: as every vessel displaces her own weight of fluid, therefore these two forces hold each other in equilibrium.

The absolute centre of gravity of a vessel can be but approximately ascertained, its position, however, is sufficiently defined to know that when a vessel floats upright and at rest, it is in the same vertical as the centre of gravity of her displacement: the centre of gravity of displacement, or as we will call it, the "centre of buoyancy," can be accurately defined by Mathematical Calculation; but for general purposes we may assume that in all well-proportioned vessels it will be at, or near to, the greatest transverse section of the vessel—*i.e.*, the midship section, or somewhat before that locality; but should we aim at perfect accuracy it must be calculated, and to achieve complete success it is doubtless the best plan too.

Except under certain circumstances which I shall hereafter refer to, the centre of propulsion of the sails should be placed as nearly perpendicular to the centre of buoyancy as possible, and if the centre of propulsion, centre of buoyancy, and a centre of lateral displacement can be brought nearly to coincide, we may assume, every other requirement being complied with, that we are getting near perfection for the attainment of high speed, easy performance and the preservation of stability. Of this latter quality, however, I must now speak; every yachtsman has no doubt read and heard of the Meta Centre; now this point may be understood to be that at which all the efforts of the hull are united to keep the vessel in a perpendicular position, this point can be found also by calculation, but at best the result of this calculation, is like that for absolute gravity, only approximative, therefore we must seek to confirm the calculation for establishing the location of this point, both by experiment, and comparison with vessels of known good qualities and reputable performance, in order to know the amount of stability possessed by our vessel.

I have said that a vessel oscillates longitudinally on her centre of buoyancy, and that if possible the centre of propulsion should be placed perpendicular to this centre of buoyancy. Now if the centre of propulsion of the sails be placed too high, and that the vessel is sailing with the wind free or dead aft, the pressure of the wind on the sails being more powerful than the resistance of the water at her bows, she is buried by the head, her stern is lifted out of the water, she cannot sail upon her proper water lines, and of course her speed and obedience to the rudder is considerably injured, besides being made crank and dangerous. If, on the contrary, the centre be too low, the resistance of the water at the bow overpowers the force of the wind, and the pressure of the water being at right angles to the bow, the latter is lifted up, and in consequence the stern is depressed, the vessel "squats" in the water, and a corresponding derangement of the proper sailing lines ensues.

From these circumstances we see that the longitudinal and vertical position of the centre of propulsion of the sails, the centre of lateral resistance, or "displacement," and the centre of buoyancy, is the great points to be determined, in order to complete the fabric we have designed; and we may also assume that we may to a great extent be guided in fixing the height of the centre of propulsion by determining it in reference to a vessel's performance off a wind; and in determining he

area of sail in connection with it by reference to her performance when close-hauled

It is by means of the sail draught therefore that the proper position for the spars of a vessel can be best determined, and in making this draught it is best to confine it to the three lower working sails of a cutter or schooner, because it is under these sails that her best qualities are likely to be called forth in heavy weather.

I have known instances where before ever the position of the masts were thought of, the plans for internal accommodation were studiously considered and arranged; and afterwards when it was recollected that perhaps after all a mast might be requisite, its proper position was sacrificed to the attainment of a gorgeous state saloon; in fact it was not to be thought of that the mast should obtrude its ungainly bulk amidst the fair proportions of the daintily decorated cabin. Elegance of arrangement in accommodation is very requisite, and all very well when it can be accomplished without involving the loss of qualities, that under peculiar circumstances might also involve the loss of life. Another source of error, and not an unfrequent one between Builders and Yacht Captains, is the getting a proper spread for the rigging; "Here I must have my mast, or I shall have no spread for my rigging," says the yacht captain. No doubt it is essentially requisite to obtain this spread for the proper support of the mast and sails; but at the same time a few inches more width in the channels will not prove one twentieth part so injurious as the improper disposition of the canvas.

## CHAPTER XVII.

> " Meantime the steady breeze serenely blew,
> And fast and falcon-like serenely flew
> Past the high headlands of each clustering isle
> To gain their port—long—long ere morning smile.—BYRON.

I SHALL now proceed to enumerate in detail some of the principal systems promulgated for the placing of cutters' and schooners' masts, and also for their proportions. In considering these systems the yachtsman will do well to bear in mind that the data upon which they are in general founded embrace certain proportions which only govern the size of a vessel, but not any peculiarity in the form of her hull; as, for instance, two vessels may be of exactly the same length, beam, and draught of water aft, and yet totally dissimilar in shape; one may have a full fine body, with rounded bow lines, and a lean after body, with fine or hollowed run, and drawing nearly as much water forward as she does aft; the other may have a fine entrance, with hollowed lines and proportionally full after-body, and may draw but little more than half as much water forward as she does aft. Now these opposite conditions of form exercise a corresponding effect upon the position of the principal centres that should be our guide—viz., the centre of gravity of displacement, the centre of lateral resistance, or displacement, and, consequently, a very important effect on the position of the centre of propulsion of the sails. Yet, ignoring these important facts, we assume that, because two vessels—respectively 80ft. long, 20ft. beam, and with a draught of 10ft.—we can, by taking a certain proportion of—say the length—accurately locate the spars. If vessels were constructed of exactly similar proportions in every respect, so that their external forms should, under certain circumstances, present similar surfaces to the fluid through which they pass, then such a rule might be reduced to sufficient accuracy; but in the present state of yacht building, where such a variety of shapes are produced, at best it can only be approximative, and serve but as an index to place the mast or masts on a sail plan, preparatory to the more

careful investigation of the position of the respective centres of the hull and sails, upon which the accurate location will more properly eventually depend. With respect to the proportions of spars set forth in these systems, they appear to be more definitely deduced, inasmuch as the proportions of vessels upon which their stability depends form the basis of the calculations.

Mr. Robert Kipping, in his treatise on "Mast-making and the Rigging of Ships," says "The form given to the vessel varies the disposition of the masts, for it is evident that a full-bowed ship requires her foremast to be placed further forward than a sharp one; consequently, 'though a general rule may be given,' still every builder should consider the nature of the form of his vessel, and vary the disposition of her masts accordingly."

The subjoined Tables No. 1, of the positions of masts under various rigs, are taken from Mr. Fincham's work, and an inspection of them may enable yachtsmen and builders to establish a comparison between known vessels, and those which they are constructing, and from thence to make such alterations as circumstances may require; in fact, the some observation will apply to all the tables I now give.

TABLE No. 1.—Cutter Yachts.

| Yachts, Length. Breadth. Ex. 1—63·11ft. 19·2ft. Ex. 2—57·25ft. 18·5ft. | Known Quantities. | Proportions in terms of known quantities. | |
|---|---|---|---|
| Spars. | | Cutter, Example 1. | Cutter Example 2. |
| Mast before the middle on the water-line ........ | Length of load water-line taken from the fore part of the stem to the after part of the sternpost | ·112 | ·14 |
| Mast to rake from water-line .................... | In 12ft. | 12 inches. | 15 inches |
| Bowsprit to stive from the water-line .............. | In 12ft. | 7½ inches. | 10¼ inches |
| Bowsprit to house from the fore part of the stem ... | Breadth | ·62 | ·53 |

In Tables No. 1, the "Load Water Line" is assumed as the principal line of bearance of the vessel, from which the stations of the masts are to be determined.

## Schooners of Three Masts—as Brig forward—Common Schooner and Bermuda Rig.

| Length. Breadth.<br>Schooners 3 masts 78·7ft 21·6ft<br>Do. Bg. for Ex. 1 110·6ft 25·6ft<br>Do. Do. Ex. 2 103·5ft 25·8ft<br>Do. Common 90·0ft 24·0ft<br>Do. Ber. Ex. 1 95·0ft 24·7ft<br>Do. Ber. Ex. 2 94·7ft 24·0ft | Cnown quantities. | Proportions in terms of known quantities. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Schooners. | | | Schooners. | | |
| | | Three masts. | Brig forward Ex. 1 | Brig forward Ex. 2 | Com Schnr | Bermuda. Ex. 1 | Bermuda. Ex. 2 |
| | Length. | Abaft | Abaft | | | | |
| Main-mast from the middle... | OnL.W.L. | ·033 | ·11 | ·107 | ·046 | ·108 | ·084 |
| Foremast before do. | Do. | ·295 | ·3 | ·294 | ·338 | ·279 | ·031 |
| Mizen-mast abaft do. | Do. | ·366 | ... | ... | ... | ... | ... |
| Main-mast to rake ............... | In 12 feet. | 27in. | 33in. | 28in. | 24in. | 24in, | 33in. |
| Foremast to rake.................. | Do. | 24in. | 28in. | 18in. | 15in. | 16in. | 36in. |
| Mizen-mast to rake............... | Do. | 30in. | ... | . . | ... | ... | ... |
| Bowsprit to stive.................. | Do. | 22in. | 36in. | 33in. | 34in. | 24in. | 22in. |

## Yacht Brigs.

| Spars. | Known quantities. | Proportions in terms of known quantities. |
|---|---|---|
| Main-mast abaft the middle..... | Length L.W.L. × | ·144 |
| Fore-mast before the middle .. | Ditto × | ·323 |
| Main-mast to rake .................. | In 12 feet × | 10 inches |
| Fore-mast do. .................. | Ditto × | 2½ do. |
| Bowsprit to stive........... ........ | Ditto × | 52 do. |

## Luggers.

| Length. Breadth.<br>Example 1 55·0ft 16·75ft<br>Ditto 2 77·0ft 22·7ft | Known quantities. | Proportions in terms of known quantities. | |
|---|---|---|---|
| Spars. | | Example 1 Common. | Example 2 Lugger. |
| Foremast before middle | Length L.W.L. | Before ·4 | Before ·396 |
| Main-mast from middle | Ditto × | Abaft ·037 | Abaft ·94 |
| Mizen-mast abaft ...... | Ditto × | Abaft ·444 | Abaft ·396 |
| Main-mast to rake ..... | In 12 feet × | ·16in. | ·12in. |
| Fore-mast do. ............ | Ditto × | ·10in. | ·6in. |
| Mizen-mast do. ......... | Ditto × | ·20in. | ·24in. |
| Bowsprit to stive......... | Ditto × | ·6in. | ·6in. |

## Latteen Rig.

| Length. Breadth. Example 125·0ft 32·0ft<br>Spars. | Known quantities. | Proportions in terms of known quantities. |
|---|---|---|
| Main-mast from the middle ......... | Length L.W.L.× | ·000 |
| Fore-mast before the middle ...... | Ditto × | ·407 before |
| Mizen-mast abaft ..................... | Ditto × | ·407 abaft |
| Main-mast to rake ..................... | In 12 feet × | ·000 |
| Fore-mast do. ........................... | Ditto × | ·23in. forward |
| Mizen-mast do. ........ ................ | Ditto × | ·12in. aft |

## TABLE II.—Schooners.

Mr. Griffiths gives us the "Danish Rule," for placing a schooner's masts as follows:—The foremast should be placed from one-fourth to one-fifth of length on the Load-Water Line aft of the perpendicular, and to rake from 4 to 10 degrees; the mainmast from one-eighth to one-ninth the length aft of its longitudinal centre, and to rake from 6 to 10 degrees. Elevation of the bowsprit from 6 to 10 degrees.

### Proportions for Schooners' Spars.

The whole length of the mainmast to be three or three-and-a-quarter times the extreme breadth, and in diameter to be one inch for every four feet of length; the mast-head to be one-eighth to one-ninth of the extreme length of the mast.

The length of the foremast to be from eight-ninths to nine-tenths of the length of the mainmast, its diameter and length of head to be the same as the mainmast.

The bowsprit outboard to be half or two-thirds of the extreme breadth of the vessel, its diameter to be 1in. for every 4ft. of length.

The jib-boom to be outboard of the bowsprit three-fourths of the extreme breadth of the vessel, its diameter to be 1in. for every 5ft. of the whole length.

The main-boom to be one.third of the distance from the mainmast to the stern—over the stern; its diameter to be 1in. for every 5ft.

The main-gaff to be two-thirds or three-fourths of the length of the boom, and its diameter 1in for every 4ft. of length.

The fore-gaff to be from 4ft. to 6ft. shorter than the main-gaff.

The main-topmast to be from 2ft. to 3ft longer than half the length of the mainmast.

The fore-topmast to be from eight-ninths to nine-tenths the length of the main-topmast.

Should a schooner be rigged with square topsails, the lower yard is to be from one and three-fourths to one and five-sixths of the extreme breadth of the vessel, and its diameter to be one inch to every four feet of length. The topsail yard to be three-fourths the length of the lower yard, and the top-gallant yard to be two-thirds of the length of the topsail yard.

## Danish Rule for Cutter's Masts.

The mainmast is to be from one-third to three-eighths the length of the Load Water Line aft of the forward perpendicular.

If any rake be desirable the greatest permitted to be 4 degrees.

## Proportions for Cutter's Masts.

If a vessel have much stability the extreme length of the mainmast to be the same as the length of the vessel on the Load Water Line; but if of moderate stability the length of the mainmast to be three times the extreme breadth of the vessel; its diameter to be one inch in every four feet: the head of the mainmast to be one-eighth of its extreme length.

The topmast to be the length of the lower mast from the deck to the hounds.

The bowsprit to be outboard twice the beam.

The main-boom to be from two to six feet over the taffrail.

The gaff to be from two-thirds to three-fourths the length of the main-boom.

In vessels sparred according to this rule, the centre of propulsion of the sails may be found at or aft of the longitudinal centre of the vessel, and its height above the Load Water Line from one-and-a-quarter to one-and-three-quarters, and to twice the extreme breadth of the vessel.

## TABLE III.—American Method of Masting Schooners.

The Americans seem to vary in their methods of sparring according

to the stability of the vessel. The following appears to be their rule for a vessel of average stability:—

The length on deck is divided into 756 parts; the centre of the foremast to be 192 of these parts from forward; the centre of the mainmast to be 258 of these parts from the centre of the foremast; the rake to vary from five-eighths, seven-eighths, to one-and-a-half inches to the foot.

The hoist of the sails range from twice to two-and-two-thirds the beam; and taking this with the division of the length on deck into 756 parts as the datum, the following proportions are given for the sails:— 336 of these parts to be the length of the foot of the foresail; 408 of these parts to be the length of the foot of the mainsail; and 204 of these parts to be the widths of the heads of both foresail and mainsail; 348 of these parts to be the length of the foot of the jib.

Mr. Griffiths tells us that these proportions are applied generally to the fast sailing coasting American schooners, and therefore they appear to be more applicable in experimenting with our schooner yachts; a sail draught made in accordance with them may prove extremely useful as a standard of comparison, for there is little doubt that such schooners as the Moses Grinnell and Mary Taylor are of no mean repute, and if report speaks true, the former vessel appears to be equal, if not superior, to the far-famed America, more particularly as to open sea work.

In the flat wide built centre-board schooners of the United States, he says, that a much greater proportion of canvas is carried, and that much of the diversity that exists is owing to the varieties of local custom, the schooners of America not being generally built in the vicinity of large cities, but wherever on the coasts timber and capital are to be commanded, and water sufficient to launch them. But taking the above-stated proportions as those under which known vessels of America have performed in every respect to the satisfaction of competent judges, it only remains for any yachtsman who elects to experiment upon this rule, so to modify, by increase or diminution as may suit his taste, or appear requisite to the form of his proposed vessel.

The American sloops appear to be masted and canvassed with a much more strict adherence to the general rule applied to them. The position of the mast is three-fourths of the beam from the forward

part of the deck; and its rake is from one-fourth to seven-eighths of an inch to the foot. The proportions of sail are—mainsail, the hoist to be two-and-a-half times the breadth of the vessel; the length on the foot to be three times the breath of beam added to the depth of hold; the length of the after leech to be three times the breadth of beam added to three times the depth of the hold; the width of the head to be once the breadth of beam, with three times the depth of hold added. The length on the jib-stay is to be the same as the foot of the mainsail; the after leech of the jib to be two-and-a-half times the breadth of beam, or the same as the hoist of the mainsail, and the length on the foot is to be the same as the width of the head of the mainsail.

Taking the proportions stated above for the placing of masts as merely approximative, and subject to such alterations as the form of a vessel may require, in order to make the centre of propulsion of the sails, the centre of gravity of displacement and centre of lateral resistence of the hull, harmonize, they may be found useful to the amateur draughtsman as a part to start from when commencing his sail draught; and then when he has made his calculations, if the centres do not harmonize according to these rules, he must shift the positions of the masts in the drawing until they do, and thus adapt their position to the form and requirements of the proposed vessel.

With respect to the dimensions of spars set forth, and also the proportions of sails, as they have been calculated according to these dimensions of the hull which involve the properties of stability, they may be regarded as of somewhat more accurate data than those given for the location of the masts, but still subject to such modifications as comparison with vessels of known good performance may warrant; and I would impress upon yachtsman the importance of obtaining when opportunity offers, the measurements of the hull, spars, and canvas, either individually or collectively, of any vessels, schooners, or cutters, of large or small tonnage, that may come under his notice; a collection of such would prove invaluable as a standard of comparison, and the plans of such vessels indexed according to their performances, would form a guide to future operations, the importance of which could not be too highly estimated.

The yachtsman who makes such a collection, and gives the yachting

public the benefit thereof, will have deserved well of his brethren of the wave, for irrespective of the time and energy required for the collection and arrangement of the requisite information, an indefinable mystery, a kind of jealous conservation, and almost selfish reticence, will have been opposed to him in many quarters, that cannot but have amply tested his patience, if not his politeness, and most certainly drawn largely on his stock of perseverance; that such should exist is strangely anomalous, but nevertheless true. There are many yachtsmen, to say nothing of builders, who are now possessed of detached information, that in itself though of value, is comparatively useless save to the individual possessor. Now, if all this information were thrown into a mass and properly arranged, every man might possibly find that from the great body he would derive ten times the amount of information he had individually contributed, and hitherto so jealously hoarded up; so that in fact all would be benefitted on a large and comprehensive scale by a co-operation of this kind, whilst at present each individual but slowly increases a comparitively limited store.

We are very far from having arrived at the perfection of yacht building and sailing yet: until we cross the Atlantic and prove over the course from Robbin's Reef light round the light-ship off Sandy Hook, or in the waters of Long Island Sound, that an English built and sailed yacht can recover the prestige we have lost, we must be content to labour onwards with the hope of sooner or later arriving at a perfection that shall enable us to accomplish this triumph.

As regards the raking of a schooner's masts, there is a great diversity of opinion; it is difficult to ascertain what gave rise to the raking of masts, but the probability may be that the system originated in some sharp bowed vessel having had her spars placed too forward, consequently the centre of propulsion also, and being at the same time too high; under these circumstances, having proved a wet and dangerous vessel, diving into the sea before the wind, and labouring severely and running off her helm when close hauled, in order to remedy such serious defects, the experiment of raking her masts was tried, and found to succeed perfectly; a discovery it might possibly have been called, whereas it was nothing more than locating the centre of propulsion of sails where it ought to have been originally, and thus hitting upon the proper distribution of her canvas, afterwards it was considered of benefit as thereby obtaining lifting power, but it is equally possible that what

is gained in lifting power is lost in the effective propulsion of the vessel. One thing is certain, that a vessel with raking masts never can derive the full benefit of her canvas, when running before the wind; and in light winds the rake is very injurious, as the sails instead of sleeping to the light airs have a tendency to fall back, and thus by fitfully filling and shaking, beat the wind out of them; the spars also must be longer and heavier, and it is impossible to get good and effective topmasts.

On the other hand the raking of the masts present certain apparent advantages when a vessel is close-hauled; the mainsail and foresail having a tendency to fall aft from their respective masts may be supposed to trim flatter, but then the question arises, does the advantage which we thus gain upon a wind, and which at best is somewhat questionable, compensate for the positive disadvantage and injury from loss of power of propulsion we labour under when running before the wind; with respect to the flat standing of the sails when she is close-hauled, if they do not do so from cut and construction, no system of raking will remedy such a defect, and a bellying badly cut sail on a raking mast will have a tendency to depress a vessel injuriously when she inclines to the weight of a strong breeze.

A very moderate rake in a vessel's masts looks well, and from our having so long associated it with the rig of a schooner it is difficult to divest ourselves of the idea that she cannot be perfect, or present a handsome appearance without it; but practically considered the less there is the better for any advantage that can be obtained by it; in a schooner without a rake there would be some difficulty in keeping the fore-stay sufficiently taut when she was closed-hauled; this is accomplished with a rake because the whole weight of masts and sails is thrown upon the stay, and this in itself is highly objectionable, to have the safety of a vessel in a great measure depending upon a single rope; in a cutter-rigged vessel, the pennants, runners, and tackles perform this duty, and therefore the addition of proper runners and tackles to a schooner's masts would obviate such a difficulty.

That a schooner can be proportioned and rigged so as to compete advantageously with cutters, depends I think in a considerable degree as to whether her masts are stepped with a rake or not, for let a schooner be close-hauled when she careens to the wind, if her masts are considerably raked they tend to depress; the lifting power gained by the

raking of the masts, be it much or little, assists this depression still more, so that this and the disadvantage suffered in running before the wind, are of serious detriment to a schooner's speed. One advantage that a cutter will ever have over a schooner is in the concentration of her canvas, yet do I not think this will prove at all times fatal to a schooner's success.

We have satisfactory evidence of what can be accomplished with the schooner rig in the Wildfire; this famous little schooner has little or no rake in her masts, and surely if ever a vessel from sharpness of lines required the assistance of the lifting power that it is supposed raking the masts imparts, she does. I have often seen this little schooner sail in weather that gave antagonists of twice her tonnage plenty to do, and she went along at top speed and as light as a bird; furthermore she has contended with and defeated some of the fastest cutters afloat; it is all very well to say that she is nothing more than a double-rigged cutter, of anything, this proves that the nearer a schooner can be rigged on both masts to a cutter the better; probably if she had not originally been a cutter, but left the stocks as a schooner, we would have accorded her the full measure of praise; but the fact of her having been built for a cutter and subsequently schooner rigged, rather prejudices us against her, particularly when we see her receiving a schooner's allowance of time, and we cannot divest our minds that to all intents and purposes, she is but a cutter still, only double rigged.

However, 'tis the rig, not the vessel, that is just now the subject of our consideration, and therefore no matter what sophistry the circumstance of her having once been a cutter may engender, we cannot get rid of the fact that she is schooner rigged; and a strong proof that rig can be adapted more successfully than heretofore for the attainment of high speed. She is to my mind strong evidence that when the centre of effort of the sail is properly located, a schooner is all the better for having but little rake in her masts. If the masts were perfectly upright it would present a very ugly appearance, as then they would seem to lean over the bows, and in fact would do so when running before the wind; but as near an approach to the perpendicular as will do away with this appearance and its results, a correct location of the centre of propulsion, and a proper distribution of the canvas, will I think bring out the best qualities of a schooner more effectually than will raked masts.

In an old work on Naval Architecture, I find the following proportions

given for the masting of a cutter :—The length on deck, breadth extreme, and depth of hold to be added together, and three-fourths of the product taken for the length of the mainmast. The mast to be stepped five-twelfths from forward.

## CHAPTER XVIII.

"I'm afloat, I'm afloat, on the fierce roaring tide,
The ocean's my home and my bark is my bride."

An ordinary rule, that is very generally followed, in proportioning the lower mast of a cutter yacht, is to take twice the extreme breadth of beam, and make the hoist of the mainsail of that length; then adding from one-third to one-quarter of this length additional, for masthead, will give the length of mast from the deck, to which the depth from the upper part of the deck to the bottom of the step in the vessel's hold being added, the quotient expresses the entire length of mast required: should an extra amount of canvas be required for racing purposes, the beam divided into parts, or if its measure in feet be equal, a certain proportion of these parts, or number of feet, added to the hoist determined as above stated, will give the amount proposed, and the length of hoist will then be expressed by $2\frac{1}{8}$ beams, $2\frac{1}{4}$ beams, &c., or whatever exact measure may be determined upon. It should be borne in mind when proportioning the masthead, that a neat short head makes a vast difference in the appearance of a vessel's rig; a long straggling masthead is a most unsightly thing, it imparts a heavy and stunted look to the main rigging, besides the useless weight aloft. Some men advocate long mastheads as giving a better fulcrum to the peak halliards when the mainsail is up, and also as strengthening the topmast; and to remedy the additional top hamper reduce it in diameter from the hounds; that it has these effects it is true, but not to such a degree as estimated: besides the fact of its being so long converts it into a powerful lever when the gaff-topsail is not set, or that the topmast is housed, and the forestay and eyes of the shrouds acting as the fulcrum, the weight of the mainsail on the peak halliards very often twists a long masthead and springs it at the eyes of the rigging, more particularly when a craft is labouring through a heavy sea, or meets with squally weather still smooth water: a short neat masthead, and yet not too short, for this too may be overdone both for appearance and utility, with the diameter carried full up to the masthead cap, is always to be prefered; the full

strength is in it to carry the weight of the mainsail, the effect of the leverage is considerably reduced, and if the jib halliard blocks be seized on above the middle peak halliard block, and the balloon halliard blocks above the upper, it is an excellent arrangement, as the weight of either jib proportionately counterbalances the weight of the mainsail on the masthead.

In some of the Yankee sloops there is a short stay from the masthead spliced into the forestay in order to meet this weight on the masthead aft—but it presents a very ugly appearance although of considerable utility. The mastheads of these sloops although notoriously short, stand greatly in need of such a support, the strain upon them not being distributed, as in our cutters, by two or three single blocks, but concentrated frequently on a two or three fall block.

That part of the above-mentioned rule which relates to the proportion of diameter requisite to the length of a mast, is likewise based upon the breadth of beam; it specifies that the diameter of every such so measured mast is to be seven-eighths of an inch to every foot of the beam; this is a simple rule, and with such modifications as circumstances might render necessary, would work well, as it gives a vessel possessed of a large amount of stability a spar of adequate length and good average substance; for cruising vessels it may be found to answer in the form I have stated; but according to the present notion of racing spars considerable amplification may be indulged in. With respect to the tapering of a mast towards the head, I should be very chary of it, if it is a long spar, it will want its entire substance carried through, from the fact that in such a spar it is a matter of great difficulty, if not of impossibility, to get a stick clear of knots; and every knot weakens it more or less: a mast for a small cutter may be selected with less difficulty, but let the yachtsman remember that every shaving that is taken off a spar to reduce it, is removing the strongest part of it; I hold an opinion that if a spar was turned end for end, the knotty part that we now make the head converted into the heel, and reduced only so much as to proportion it to the diameter below, it would be a stronger and more serviceable conversion of that spar; the greatest average working strain upon a mast is not at or near the deck at all so great as it is from one to two-thirds up to and at the head.

I was first induced to form this opinion by seeing a large cutter overhauled that had gone through a great deal of hard service upon a wild

coast and in stormy weather, where she had to contend against the weighty seas of the Atlantic; she had a large winch which was attached to the mast by a broad and heavy iron band, not galvanized: this band had discoloured the mast above and below it considerably; the boom was fitted with a goose neck that worked in an eye welded upon the band. During the overhaul it was resolved that this band should be got rid of, and a light saddle with spider hoop and suitable winch substituted. Upon removing the band the mast was found to be so severely sprung underneath it, that guys had to be attached to the mast to prevent it tumbling overboard, and sheers immediately rigged to remove it: now had there been a working strain on the lower part of the mast greater than that upon the head, it must have been twisted out of this band; but from the appearance of the parts where it was sprung and the iron rust having penetrated considerably into the transverse cracks, the inference we deduced was that this mast had been sprung for a considerable time, and that it rested in this band as in a step, the lower half of it being quite firm on the stump; she had just gone through a winter cruise of unexampled severity, and upon questioning her master he informed us that he had frequently observed the mast to yield a little at the band, but could not understand the reason of it: if he had known it to have been sprung in the state in which he saw it when the band was taken off, he declared he would have as soon thought of drowning himself and all hands as gone through the seas and storms he had encountered.

The next point we turned our attention to was how the mast could have been sprung at this particular part; this, however, was easy of solution, the working of a heavy winch, the action of the boom upon the goose neck, and the repeated screwing up of the iron band to resist these assaults, had so compressed and crushed the external and strongest layers of the spar, that a very slight and sudden shock might probably have caused it, such as the vessel might have experienced in contending with a heavy short head sea, or by being struck by a sudden squall.

With regard to the turning of a spar end for end, it is merely an opinion; I have never seen it experimented upon, although I have been informed that spars made from balks have been treated so, and some instances have been mentioned to me of whole spars, yet as I have no personal knowledge of it, I cannot speak to it: I think, however, it is worthy of consideration and trial.

It may not be out of place here to say a few words relative to the

different descriptions of pine used for spars, together with some particulars of the growth, and the countries which furnish the vast supplies annually consumed in Great Britain; for the masts and others spars of yachts, as well as much of the timber used frequently in the construction of the hulls, the Pines and Firs, or cone bearing trees, that grow and thrive best in cold countries, are, from their lightness and toughness, coupled with their elasticity, found admirably adapted to such purposes. The only other wood I have ever seen used in constructing a mast was Teak; I saw a Chinese junk with a teak wood spar, but as Rangoon teak is only of the same weight in lbs. per cubic foot as American yellow pine—viz., 26·7lbs., if it was of that description it would only be an average weight; but if of Malabar teak it would weigh 53lbs. to the cubic foot, or 1lb heavier than English Oak, and certainly a vessel that could carry such a stick must have been a miracle in her way.

The principal markets from whence we obtain our masting spars are British North America, Norway, and the Baltic, Riga, Memel, Dantzic, Stettin, &c., but of all pine bearing countries New Zealand bears away the palm. Could we obtain the same facilities of importation from thence as from other countries, we should have such spars as would gladden the most fastidious yachtsman's heart. A specimen of the New Zealand spars may be seen in the Queen's yacht, Victoria and Albert, which were brought over specially for the purpose, and perhaps handsomer sticks could not be seen in any other vessel in the world.

The principal varieties of pines and firs that are used for the masts, spars, and hulls of yachts, and generally in naval architecture, comprise amongst them some of the most important of our forest trees, and whether we consider them with regard to the value of their timber, which in a commercial point of view equals that of oak, or for the value of their secretions, which supply us with pitch, oil of turpentine, Canada balsam, &c., the pine tribe constitutes a supply, the vast importance of which can scarcely be estimated. The timber is usually considered of the best quality, if found in cold exposed situations, and the slower the growth the better: the commercial names under which it is known are Deal (or White Fir), Fir, Pine, and Cedar. The names of some of the principal varieties used for the above purposes are as follows:—

*Pinus Nigra.*—The Black or Double Spruce, is valued for the lightness, strength, and elasticity of its timber; it is obtained in the

mountainous districts of Nova Scotia, also of Carolina, and further amidst the inclement northern district.

*Pinus Canadensis.*—Or Hemlock Spruce, is of slow growth but noble proportions, its average height is 80 feet: the timber is not considered good. It is very abundant in Nova Scotia and in New Brunswick, as also near Quebec and in the State of Vermont.

*Pinus Resinosa.*—The Pitch or Red Pine of the Canadians, which grows to a great height, and is remarkable for the smoothness and red colour of its bark, as also for the quantity of resin it yields; it grows in close forests in Canada and the northern regions of America.

*Pinus Strobus.*—The White or Weymouth Pine grows to an immense size, having been found 200 feet in height; this pine makes first-rate spars; it is found in Canada, the United States, and in the district of the Bay of Fundy.

*Pinus Rigida.*—The Pitch Pine; the timber of this pine is not considered of a very good quality; it is cross grained and saturated with tar; it grows throughout the United States, and is generally found in poor soils.

*Pinus Mitis.*—The Yellow Pine, yields fine and durable timber, and grows in the middle and northern districts of America.

*Pinus Australis.*—The Southern Pine; the timber of this tree works clean, is light and durable; it contains much tar, and makes excellent spars; it is found in the central districts of North America.

*Pinus Sylvestris.*—The Scotch Fir yields the Red and Yellow Deal, it is considered to be the hardiest species of pine, and most valuable; it yields very large quantities of pitch, tar, and turpentine; it grows upon the mountains of Scotland, in Northern Europe, and North America, It reaches a height of 90 feet.

*Pinus Larix.*—The common Larch; this tree takes rank in value next to the Scotch Fir; the timber is heavy, very tough, and closely grown; it makes fine planking for vessels. In England, Scotland, and Ireland it flourishes well on barren and exposed land; it is found in the mountainous districts of the middle of Europe, and prevails largely in Russia and Siberia: 45 feet is said to be its average height.

*Pinus Abies.*—The Norway Spruce; this pine furnishes the White Fir or Deal timber; it grows in a straight stem from 150 to 200 feet in height; it is found in Northern Europe, and takes its name from Norway, where it is principally found: it makes fair spars.

*Pinus Picea.*—The Silver Fir; this tree grows to large dimensions, and yields very fine timber for shipbuilding purposes; it is a native of Germany, Switzerland, Italy, and Siberia.

*Pinus Pinea.*—The Stone Pine, yields also excellent shipbuilding timber, it is found in Southern Europe and the Levant.

There are many other varities, but these may be sufficient to interest the yachtsman. The above are according to the arrangements of Humboldt and Schouw.

With respect to the selection of timber for spars, in order to understand the principle upon which the best adapted for the purpose may be picked out, with your liberty, good Mr. Yachtsman reader, we shall refer to for a short space to our School-boy-day studies, and in order to comprehend these principles thoroughly we will succinctly investigate the growth of trees. There are two descriptions of trees, the first having what is scientifically known at "exogenous" stems, or those that grow by the addition of wood "on their outward surface," underneath the bark. The second are those characterized by "endogenous" stems, or those that "grow inwardly," from the centre, and which latter class are further known by the comparative thinness of the coating of bark, their covering in this respect being nothing more than a thin cuticle. It is a curious fact that it is between the family of Pines and Palms, which may be considered in some measure related to each other, that this great difference most strikingly occurs. The Pine is "exogenous," the Palm "endogenous;" the former thrives best in cold exposed regions, the latter is chiefly found in tropical regions; and here one of the many beautiful provisions of nature is exemplified in the absence of bark from the Palm: one of the principal duties of the bark being to "protect the sap" from which the wood is formed on the outer surface, but there not being any flow of sap externally in "endogenous" trees the bark becomes unnecessary.

Another striking difference in the structure of these trees is the provision that enables the Palm to attain such a great height; the wood growing from the centre (*i.e.*, "endogenous") soon reaches the diameter its vital functions are capable of supporting, and then the wood forming sap instead of being distributed over the external surface underneath the bark, as in "exogenous" trees, is progressively deposited at the summit of the stem, and thus the tree grows vertically after a certain period, without any considerable lateral expansion.

The number of concentric zones, or rings, that may be observed in the traverse section of a tree, indicate the number of years of its growth, and I will here make an extract from Orr's "Circle of the Sciences," which will completely illustrate this part of the subject.

"The inclosure of zone within zone is owing to the mode in which the wood is produced, and the position in which it is deposited. Wood is formed by the leaves during the growing season, and passes down towards the root between the bark and the wood of the previous year (if any), or in the position in which cambium is effused; and as the leaves more or less surround the whole stem, the new layer at length completes a zone, and perfectly encloses the wood of all former years. This is the explanation of the term "exogenous," which is derived from two words signifying to grow outwardly, for the stem increases in thickness by successive layers on the outer side of the previously formed wood. That this is the mode of growth has been abundantly proved by experiment and demonstrated by accidental discoveries. Thus, if a plate of metal be inserted between the bark and the wood, it will in progress of time become enclosed by the new wood which has overlaid them. So in like manner if letters be cut deeply through the bark and into the wood, the spaces will not be filled up from the bottom, but may be seen in subsequent years overlaid by new wood. These facts prove that the wood is applied from without. Again, if a branch be stripped of its leaves down to a certain point, it will not grow above that point; and so, in like manner, if branches be stripped from one side of a tree, the tree will not grow on that side. If a circle of bark be removed from a branch above and also below a leaf, it will be found that increase of size will occur below, but not above that bud; and so, likewise, whenever a ring of bark is removed from a tree, the new woody fibre will not proceed from the lower but from the upper edge."

In choosing a spar, therefore, the manner of growth of the tree should be remembered, and a stick selected that from its natural size will require very little reduction to make it suit the vessel for which it is required; it should be very carefully examined for knots, rind-galls, and shakes; a short piece sawn transversely off both the butt and the head will enable the heart to be examined; it denotes a well-grown stick if the centre, or heart, of the concentric rings or zones of wood is in the middle of both butt and head, but if the heart is more to the side at either butt or head, and then it denotes that the tree either

in part or whole, is not fairly grown, and that the wood forming sap has been distributed unequally: if there be pale red, or pinkish and white spots pervading it, or any symptom of rot at the heart, or radiating shakes of any serious magnitude, particularly those which coincide at the diameter, the spar should have other pieces cut off until it be ascertained sufficiently whether such defects are local or pervade throughout. Having determined the nature of the butt and head, the sides should next be carefully examined with an adze, chips taken off here and there and the sap cleared away down to see its depth to the sound wood; every knot cautiously examined at to whether it is sound grown, or resinous, or rotten; and here let me say that too much particularity cannot be exercised in the testing for soundness and comparing the position of whatever knots may be found in a spar; this latter point is too often overlooked, if knots are evenly spread over the stick, and at equal distances from each other, and that they are sound, they are not of such serious consequence; but where two or three knots grow in the same horizontal ring round the stick, it forms a terribly weak spot; or a very large knot which makes the wood to curl about it is very often fatal. If knots grow very thickly about the head and lie closely together, the timber will be found very curly and weak.

## CHAPTER XIX.

"Haste! with your weapons cut the shrouds and stay,
And hew at once the mizen-mast away,
He said; to cut the girding stay they run,
Soon on each side the several shrouds are gone,
Fast by the fated pine, bold Redimund stands
The impatient axe hung gleaming in his hands."—FALCONER.

BY the selection of a stick for a mast that requires little more than the bark to be removed to suit the specified dimensions, we get what is called a "self-coated" stick, and by strict attention to the concluding remarks in Chapter XVIII., a superior spar may be depended upon. In some spars the layers of wood are deposited during growth in a spiral fashion; these are known in some localities under the name of "twisted sticks;" it is, however, the natural form of the tree, and imparts additional strength. I have seen some of these "twisted sticks," as they are called, which it was almost impossible to carry away; their toughness, elasticity, and strength are wonderful; they are rather scarce, but when obtainable are well worthy the yachtsman's attention. In contradistinction to the self-coated spar is the "Balk" spar; this is the balk or beam of squared timber which may be ordinarily seen in our timber yards, ready for cutting into planking, posts, rafters, &c. Such of these balks as are of close grown texture, evenly coated, and averagingly free of knots, are picked out for making spars with; but they rarely turn out such good sticks as the self-coated spars, owing to the reduction of the best of the timber in order to convert them to the required size; if these balks were "eight" instead of four squared, they would turn out more advantageous for spars, or indeed for any use. All that is requisite is to get rid of the sap, as the very best timber lies next the sap; but in squaring these balks much valuable timber is cut away; the four angular points of the balk representing the contact with the sap. A glance at a beam of this timber will at once shew what a quantity of valuable surface has been cut away to make it square; and then to construct a spar from this square of timber, the corners have to be removed,

or, in fact, the portion of the best timber after squaring it; whereas, were these balks more generally prepared eight squared, the sap would be efficiently removed, the best timber preserved, and the balk more easily convertible into a serviceable spar.

Of the various descriptions of pine that grow, four are in general used for making spars:—the Pitch pine, the Red, the Yellow, and the White. The Pitch pine makes a good spar, but its great weight is against it; and although with some it is a favourite spar, I think it is much over-rated; the Red pine is *par-excellence* the favourite for masts amongst yachtsmen; but the Yellow and White make very fine sticks. Of the specific gravities of these timbers and other properties, &c., I will here introduce some information that may prove useful to yachtsmen.

From the experiments made by Mr. James Jarvis, of Virginia, Inspector and Measurer of Timber for the American Government, we derive the following:—The specific gravity of fresh Yellow pine felled about ten days.

| | | | | |
|---|---|---|---|---|
| In the square:— | Cut in March, | ·581 = | 36lbs. | 5oz. |
| | Cut in April, | ·683 = | 42 | 11 |
| In the round:— | Cut in September, | ·828 = | 51 | 12 |
| | Cut in July, | ·751 = | 46 | 15 |

These are the maximum and minimum weights for twelve months, and the excess of the timber weighed in the round to that weighed in the square, is accounted for by the quantity of turpentine contained in the sap. The average specific gravity for the year is stated by Mr. Jarvis to be:—Square Yellow pine = ·637 = 39lbr. 13oz.
Round do. = ·781 = 48 13

Dry season timber he averages as follows:—

| | | | |
|---|---|---|---|
| Pitch pine of Virginia | ·680 = | 42lbs | 8oz. |
| Common Yellow pine, Virginia | ·536 = | 33 | 8 |
| White pine, Susquehanno | ·418 = | 26 | 2 |
| Long Leaf Yellow pine of Wilmington, N.C. | ·610 = | 38 | 2 |

Tredgold gives us the following data:—

Fir—"red" or "yellow." Specific gravity, 0·557: weight of a

cubic foot, 84·8lbs.; weight of a bar 1 foot long and 1 inch square, 0·242lbs.; will bear on a square inch without permanent alteration, 4,290lbs. = 2 tons nearly, and extension in length of $\frac{1}{470}$; weight of modulus of elasticity for a base of an inch square, 2,016,000lbs.; height of modulus of elasticity, 8,830,000 feet; modulus of resilience, 9·13; specific resilience, 16·4. Compared with cast-iron as unity, its strength is 0·3; its extensibility, 2·6; and its stiffness, 0·1154.

Fir, "white"—Specific gravity, 0·47; weight of a cubic foot, 29·3lbs.; weight of a bar 1 foot long and 1 inch square, 0·204lbs.; will bear on a square inch without permanent alteration, 3,630lbs., and an extension in length of $\frac{1}{504}$; weight of modulus of elasticity for a base of an inch square, 1,830,000lbs.; height of modulus of elasticity, 8,970.000 feet; modulus of resilience, 7·2; specific resilience, 15·3.

Compared with cast-iron as unity, its strength is 0·23; its extensibility, 2·4; and its stiffness, 0·1.

Gutch gives us the specific gravity of a cubic foot in lbs., thus:—Yellow Fir, 41·1; White do., 35·6.

Templeton, in his "Practical Medicines," states under the head of "properties of bodies"—

| Names. | Specific gravity—Water being 1,000 | Average weight of a cubic foot in lbs. | Cubic feet in a ton. | Ultimate cohesive strength of an inch square prism in lbs | Comparative Stiffness. | Comparative Strength. | Comparative Resilience. |
|---|---|---|---|---|---|---|---|
| Riga Fir | 753 | 47 | 48 | 9540 | 98 | 80 | 64 |
| Memel do. | 546 | 34 | 66 | 9540 | 114 | 80 | 56 |
| Scotch do. | 528 | 33 | 68 | 7110 | 55 | 60 | 65 |
| Christ. white deal | 590 | 37 | 60 | 12346 | 104 | 104 | 104 |
| American white spruce. | 551 | 34 | 66 | 10296 | 72 | 86 | 102 |
| Yellow Pine | 461 | 28 | 80 | 11853 | 95 | 99 | 103 |
| Pitch Pine | 660 | 41 | 54½ | 9796 | 73 | 82 | 92 |
| Larch | 530 | 31 | 72 | 12240 | 79 | 103 | 134 |

The proportions and the fitting of the topmasts of both cutters and schooners, is a branch of our subject to which I would beg most earnestly to draw the attention of yachtsmen: the topmast of a cutter should be a nice tidy spar, and the shorter the better; the same may be said of schooner's topmasts; very often long swaggering topmasts are seen, and the gaff-topsail obtained thereby is considered a triumph of science and art; I wish such successful artists every joy of their

triumph, and were I about to sail a match against my bitterest enemy I would not wish him worse than such a description of topmast.

The generality of our racing or cruising yachtsmen do not pay one tenth of the attention requisite to the proportions and fitting of this most important spar. It should be, as I have said before, as snug as possible, and be fitted to work so that it can be housed or got on end as easily as winding a watch; the great body of a gaff-topsail should be got by a high peak, and not by a square head, and a high peaked gaff-topsail is the only one that will ever be found to stand properly on a wind. When a vessel is close hauled the boom forms one angle with her keel, the gaff another, and the gaff-topsail yard a third; and if mainsail and gaff-topsail are square headed, the latter is in nine cases out of ten, perfectly useless on a wind; with a short neat topmast the peaked gaff-topsail can be got to perfection, and then if circumstances compel the carrying of the top-mast on end when the gaff-topsail is struck, there is not half the wind-draught or weight aloft to be carried; but the top-mast should be so fitted that, if the topsail is struck if only for ten minutes, it should be housed with the greatest ease, working in the masthead cap and lower cap as easy as the piston of a steam-engine. To effectually secure this, it should be most accurately fitted to work true in the iron cap at the mast head, and also in the lower cap. The sheave in the mainmast-head for the top-rope should be of sufficient diameter, and work smoothly and with the slightest effort; and the top rope itself should be fitted in the score of main and top-masts, so that not a chance of its jamming should occur; besides these, great care should be taken that the eye of the collar of the fore-stay is made sufficiently long to obviate the likelihood of the heel of the top-mast jamming in it, whilst in the act of being housed.

No topmast should ever be kept standing a moment at sea, when not required to set a topsail, except a vessel be running before the wind and that the breeze is expected to moderate and enable her to set lofty canvas. Any experienced cutter sailor knows well what an immense relief it is to a vessel to get her top-mast and cross-trees down on deck in heavy weather; none but those who have witnessed the effect produced can possibly have the slightest idea of it. I have seen a vessel labouring heavily, and wetting all hands fore and aft, and the simple act of getting her topmast and cross-trees down on

deck made all the difference; she went along as fast again, as buoyant as a bottle, and dry as a western hooker. Many and many is the fine race I have seen lost through the neglect of this precaution; the moment a gaff-topsail begins to shake when a vessel is on a taut-bowline, it is worse than useless, for it then becomes injurious and shakes a vessel down to her very keelson; and yet how often is a shaky topsail carried racing and cruising, owing to the fact calling forth the remark—"It will take so long to get it down, and the topmast is so stiff, it won't house easily, so we may as well leave the topsail up until we get the wind free again!"

Such a state of things should not be permitted to exist in a properly found and properly sailed vessel; a top-mast should be used just the same as the gaff-topsails; to go up or down exactly as the moment or circumstances may require it; nothing can be more lubberly and unseamanlike than a great swaggering spar aloft when there is no earthly use for it; and when there is no use for it, it becomes a hindrance to progress and an injury to speed, and should be therefore housed or struck at once.

*Apropos* of the high peaked gaff-topsails, there is a plan which has existed amongst fishermen for some time, and lately has much obtained amongst yachts; it was, I believe, first introduced in the Thames by T. Groves, Esq., one of the founders of the Royal Thames Yacht Club; it is that of a light rope used as a gaff-topsail-peak-halliard; this line is bent on well up on the yard, and led through a sheave or small tail-block at the topmast head, and from thence down on deck. This peaks the yard up well, and relieves the strain on the topsail tack, making the sail to set beautifully; if to this be added a bowline, a topsail can be set like a card by the wind: the bowline bridle should be a span, having his legs spliced into the bolt rope on the thirds of the luff of the gaff-topsail; then, when the bowline is bent, the running part should be led through a small tail block lashed at the bowsprit end, and the fall taken in forward: the bowline must be bent after the topsail is set; with these adjuncts to the present method, a very indifferently cut topsail may be made to set astonishingly effective, and a well-cut one to the acme of perfection.

With respect to the length and substance of the bowsprit of a cutter, it altogether depends upon her shape and the draught of water forward; but whatever it be, it should be fitted to work as easily as

the topmast, so that it can be reefed to each change of jib, or shoved out again. If the topmast, when housed, relieves a vessel, how much more will the bowsprit? This, also, is a point upon which much remissness exists, not only in fitting the spar at the first going off, but very frequently oftener in working it at sea. Men seem to have an idea that once a topmast and bowsprit is put into a cutter, there they are to stay, fair weather or foul, before the wind, or working into the wind's eye. Now these two spars should be shifted, and fitted so as to be capable of being so shifted, as often as the sails that are set upon them; fore-mast Jacks always complain of the trouble attending the doing and undoing of such little jobs; they are generally too obtuse to observe any benefit resulting therefrom, and if the sails are taken in, shifted, or set, that is all they bother their heads about; they never think of the immense leverage exercised by a heavy bowsprit run all the way out in a heavy sea, how it takes a vessel's head down and pins it there, until the weight of the sea on one end and the lively struggle of the vessel for relief at the other, sends it flying out of her altogether.

In fitting a bowsprit the gammon iron should be made full large for it, it should work more from the fid at the bitts than from the stem head; it is an excellent plan to have it fitted with a square heel to work loosely but accurately between the bitts; there should be a large Lignum Vitæ roller in the top of the bitts, on a stout transverse pin; along the top of the heel of the bowsprit there should be a galvanized rack-plate the length of the reefs in the spar, and the Lignum Vitæ roller should have a score turned out of its centre to admit of the passage of this rack-plate beneath; then a stout pinion wheel fitted to the bitts, with a good serviceable key-shank handle, will enable the bowsprit to be run in or out in any weather and with the greatest ease.

The fid of the bowsprit should be a good solid square pin that will heel home against the bitts well. There is a great strain on the bowsprit fid, and if this be not looked to at the outset, a round iron fid of not half the requisite strength may be put in; it becomes bent from the strain almost immediately, and there it remains to the last days of the spar, a patent obstacle to reefing the bowsprit—too bad to work and too good for a lazy skipper to get altered, and thus creeps in the causes of lost matches and uncomfortable cruises; if not

in the bowsprit or topmast, in perhaps some other part of the fittings or gear; one evil is prolific of many others; but if we commence at the root and see that everything works well and is properly fitted, there is no excuse for a vessel not being properly handled.

As a general rule the draught of water forward regulates the length of the bowsprit; if the draught is nearly the same forward as it is aft the vessel will have a tendency to "gripe," or eat into the wind when she is close hauled; and to counteract this tendency she must carry a long bowsprit, in order to set a corresponding large jib: this is more noticeable and serious in long narrow vessels than in short and beamy ones; in the former it becomes a serious fault indeed. Very often a complaint is made of a long narrow beamed vessel being slow in stays; in nine cases out of ten the evil will be found to originate from the deep fore-foot of the ship; the tendency to gripe thereby induced necessitates the carrying of large head canvas, in order to balance the after sail and keep her head out of the wind; the moment, therefore, the helm is put down, a struggle takes place of rather a curious nature; the rudder, in forcing the stern aside, finds that the imaginary pivot or centre, on which a smart ship should turn instantaneously, is all astray. The lateral resistance forward on the bow, owing to the draught of water, neutralises a portion of the effect of the rudder, and the vessel although she comes up a little to the rudder, yet head-reaches tremendously. The large head canvas, the moment the jib-sheet is let go, deadens her way; a fresh application of the rudder is required to get her round, and this second touch of the tiller is an effectual stopper. She then becomes sluggish, head-reaching slowly still in a great circle; and at length, when she does catch the wind on "t'other" side of the forestay, she has to be boxed off with the foresail, and sometimes perhaps, with the jib also, the climax of which manœuvre is a clever stern board, and over she goes well on her beam ends before she gathers life and way again.

Now this should not be—the beauty of a cutter is her smartness in stays; her great *forte* is in turning to windward, and she should go about in stays with the least effort of the tiller. In simple fact "the" sail of a cutter should be her mainsail, and the smaller and lighter head sails she carries the better she will go; her forefoot should be well rounded up; lateral resistance can be gained by curving the keel to half the distance forward of the midship section, and from thence rounding

up the fore-foot gradually but well, for this loss of lateral resistance is the evil set forth against the far greater evil of a deep fore.foot. Another argument is that the floor is shortened.

In the long, narrow vessels that are built now-a-days, the floor can be kept quite as long as necessary for speed and ease, and the fore-foot well rounded up at the same time. By getting rid of the gripe forward, a small bowsprit and small head canvas is obtained, and the centre of effort of the sails being properly located in respect to the centre of longitudinal vertical section, a vessel will then be sailing where she looks, and not struggling under a pressure of canvas set for the purpose of keeping her away from the point she ought to be boldly looking at. Besides all this, the leverage of a weighty spar as a bowsprit is tremendous; any yachtsman who has been caught in a heavy gale must have noticed the great relief afforded to his vessel by taking even a light bowsprit in on deck, and now that the bluff, round bows, have, it is to be hoped, disappeared for ever amongst us, yachtsmen should be doubly particular with regard to every circumstance in the building of a vessel that affects the proportions and functions of this important spar.

In the present sharp bowed vessels a great difficulty often occurs in getting spread to the bowsprit shrouds ; to remedy this, iron "whiskers" have come extensively into use, and on the proper fitting of these whiskers a great deal of their utility depends. It will not do to have a pair of iron rods hooked on to eye-bolts screwed on either side of the stem, and then seized to the shrouds ; such a method of fitting is worse than useless—the working of the bowsprit soon knocks them astray, and once a vessel is underway, and that a whisker goes wrong, it is impossible to set it in working order.

I have seen many a bowsprit carried away, and not a few matches lost, owing to want of attention to these, apparently trivial, but in reality important matters. Whiskers should be made of the very best and toughest iron and galvanized ; the one on that side of the stem on which the bowsprit launches, should be the diameter of the bowsprit longer than the other. Both should have stout square shanks and square sockets, riveted through, not screwed on, the stem ; on the outer ends there should be forged jaws, like the jaws of a gaff, flattened and then rounded off like an iron thimble, so that the shroud should play easily in them ; a key should be fitted in each shroud jaw to

prevent the shrou[illegible] side, as must be the case if not thus prevented, w[illegible] with the weight of the jib. Some whisker jaws [illegible]aves, but they are, in my opinion, unnecessary; [illegible] the weight without corresponding advantages, [illegible] chips, &c., getting between them and the jaw[illegible]hereas a properly flattened and rounded off jaw [illegible] never get jammed; each whisker should have [illegible]n eye just abaft of the shroud jaw and setting [illegible] flush of the bow: if these rods are fitted with sq[illegible] the eyes on both whiskers and bows, and set up wit[illegible] will be found very complete.

In connection with this branch of the subject, it may not b[illegible] place to touch upon the methods of setting up the bowsprit shrou[illegible] generally adopted: the "block" and "fall" system is, as every ya[illegible] man knows, the prevalent method; it is a bad system from its clum[illegible] ness, for the moment a vessel heels over to a breeze, the lee bowsprit shroud tackle constitutes a regular drag in the water; and beyond this we never can get a satisfactory pull upon the fall to set up the shroud when the vessel is underway; the best plan of setting up bowsprit shrouds that ever came under my notice was that adopted in the Audax cutter, 59 tons, John Henry Johnson, Esq., built by Harvey, of Wivenhoe. The shrouds are of galvanized wire rope; at the distance of the close reef of the bowsprit galvanized chain is spliced to the rope, and this chain leads through scores in the bulwarks just forward of the shrouds, three links of extra length and stoutness mark the reefs, and the chain falls are set up with luff tackle purchases to ring bolts in the deck: thus no drag is offered externally, nothing to catch water or weeds, and a powerful purchase is always ready whereby to get a pull upon either weather or lee shroud when requisite.

## CHAPTER XX.

"Their little bark her men of watch descry,
And ampler canvas woes the wind from high,
She bears her down majestically near,
Speed on her prow and terror in her tier."

BYRON.

THE next spar that demands attention is the main-boom: this stick, one of the most important in a yacht, requires careful selection, quite as much as the mast itself; from the great length and diameter of the booms carried by our present class of cutters, it is essential to obtain in ar lightness combined with great strength; there is a tremendous strain upon the boom of a cutter yacht, the more particularly a racing craft, and although the weight of the stick is well down in the body of the vessel, yet the dimensions requisite to ensure the strength required to withstand this great strain, involve a weight of spar that seriously influences the performance of a vessel in a heavy sea. Let any yachtsman watch the boom of a cutter when she is close-hauled, with a fresh breeze, and in lumpy water; it is perfectly astonishing how it will buckle and spring with the weight of the mainsail on the clew, and to look at such a stick when a vessel is lying quietly at moorings, it appears almost a stretch of credulity to believe that such a mass of solid timber would yield an inch; and yet it is not only inches but feet these spars will buckle sometimes; the relief that a vessel experiences, and gives ample evidence of, when the mainsail is stowed, the trysail set, and the weight of the boom thus taken off her during a gale of wind, should be sufficient to have awakened our attention long since to some application of mechanical skill whereby the hampering weight of the booms in present use might be reduced. Unless a boom is stiff and unyielding it is next to useless; the best cut mainsail in the world will become as baggy as an old pair of boots unless there be a good stiff stick along its foot to set it; every inch of buckle in a boom bags a mainsail more or less; and therefore the present booms are made of such substance, to avoid this buckling and obtain the necessary stiffness,

that the weight of timber used in such a spar becomes a matter of serious consideration; lacing a mainsail to a boom strengthens and stiffens it considerably, and a much lighter spar may be made available where lacing can be used; but unfortunately lacing has been condemned in our seas,—our waters are too lively. What has answered in the smooth courses of Long Island Sound will never do amongst the overfalls and tidal runs of our Channels, so that we cannot avail ourselves of that hint from Brother Jonathan, no more than we can convert his centre-board smoothing irons into hard weather cruisers.

To avoid the buckling I have just adverted to, main-booms are made much grosser than they used to be in the centre of the spar; that this is necessary is evident from the reasons before adduced, but I think that the great extra strength allowed in the middle of the stick is frequently carried too far at both ends; a boom should be proportioned more after the fashion of a well shaped cigar, and the weight at the ends reduced to a minimum; the strain upon the jaws and at the clew, although very considerable, is not by any means so severe as that upon the middle of the boom, and therefore extra substance at these points is not only useless but injurious.

Opinions appear to vary very much as to the fitting of a boom with wooden jaws or an iron goose neck. I have sailed in dozens of yachts fitted in both ways, and I must confess that my experience dictates a preference for the goose neck; wooden jaws, no matter how light, and neatly they are fitted, are more or less clumsy, and I do not think they are a bit stronger than goose neck fittings: in point of fact, I do not see any advantage they possess over the iron fittings, on the contrary in large vessels where the mast bitts are fitted close to the mast, the boom frequently jams the lee falls most inconveniently, besides chafing the ropes. Any yachtsman who has suffered from the creaking of boom jaws against the mast during the stilly hours of a calm night, will bear testimony as to their intolerable nuisance in this respect alone; and upon the whole I see no reason why they should be preferred. I have heard it asserted that a goose neck fitting is much more liable to be carried away, but during a tolerably long experience in all classes of vessels, and all sorts of weather, I have never witnessed the occurrence of such an accident. If a goose neck is properly fitted with a tumbler joint, giving free vertical and lateral play to the boom, and that the iron work is well and soundly forged, with a due regard to

proper strength for the weight of boom carried, it will be found quite as strong, if not stronger, than wooden jaws; it makes a much neater and more yacht-like finish, gives plenty of room for belaying the necessary ropes about the foot of the mast; and should it be necessary to unship the boom, and lay it along the deck fore and aft, during heavy weather, it will stow much more conveniently than the horns of wooden jaws will permit of; added to this a boom can be fitted much closer to the deck with a goose neck, and that this is a desideratum, will I think, be generally admitted. Another objection advanced to the iron goose neck fittings, is that they stain the deck, and iron mould the tack of the mainsail; but now when yachts have every particle of their iron work fittings, that are exposed to the action of the weather, galvanized, this objection no longer remains. Every boom should be fitted with a traveller, neatly covered with leather, and having a galvanized chain tye, and hempen tackle, for the purpose of getting out the clew of the mainsail. If the clew of a mainsail is permanently lashed to the outer end of the boom, an undue strain is brought upon it, more particularly when the sail becomes wet; the consequence is that the clew is wrenched and elongated, and occasionally both bolt rope and canvas will give way; and even should they not do so a nasty hollow is produced at the foot of the after leech, exceedingly offensive to a critical eye, besides the injury it is productive of to a well cut leech. But with a properly fitted traveller the sail can be eased up or hauled out as occasion may require. The bee blocks for the reef pendants of the sail, should also be very accurately placed on the boom, so that the pendants will bring down the reefs properly, in either wet or fine weather.

The carrying away of a boom is one of the most dangerous accidents that can occur to a yachtsman, for with the great power of the mainsail acting upon it, it may either sweep the deck of the crew, or the broken end that remains attached to the clew may drive a hole in the vessel's side or quarter; therefore every precaution that skill and experience can bring to bear in the selection and substance of a spar for such a purpose, coupled with a judicious care as to the weight of timber used to procure rigidity, for the purpose of properly stretching the foot of the sail at all angles, should be used.

In connection with the subject of the weight of the main-booms of cutters, I cannot too strongly impress upon yachtsmen the necessity of adopting every improvement by which lightness of material combined

with strength can be obtained. It is all very well to say that because the main-boom is situated low in a vessel, that the weight does not signify, so that the loftier spars can be made light; this in part is true, but it must be borne in mind that every ounce of unnecessary weight placed above the water-line, tends to counteract the effect of the ballast: a weighty main-boom therefore exercises a powerful influence upon the stability of a cutter yacht, and that this is true is borne out by the fact, that all cutters, when cruising in heavy weather, have recourse to their trysails, and under such canvas perform vastly better, chiefly owing to the weight of the boom being got rid of, either when running, reaching, or close-hauled. When the boom is lashed amidships, under such circumstances, its weight is brought to coincide more with the centre of gravity in the line of the vessel's keel, and the vessel is considerably relieved; and when the boom is unshipped altogether and stowed upon deck, the weight aloft is brought still lower, and acts more in unison with the ballast below. Therefore when a vessel has her topmast and crosstrees on deck, and her bowsprit housed, her boom unshipped and stowed, and storm canvas set, it is the last resource of seamanship to assist her in combatting successfully with a heavy gale and stormy sea; but if we can assist her by reducing the weight of her mainmast, bowsprit and boom, at the outset, it is reasonable to suppose that she will be much improved, and perform better in average weather, in the same proportion as she does when relieved of them altogether in stormy weather.

To attain this desirable end it becomes necessary to adopt some other method in the construction of these important lower spars, than that at present followed; and with a view of drawing yachtsmen's attention to the best means of developing this effectually, I will refer them back to Chapter I.

Hollow spars, so far as the information we at present possess, were first brought prominently under notice of the yachting public by Messrs. Fish and Morton of New York, yacht builders, and manufacturers of hollow spars. That the important application of these hollow spars in fitting out cutter yachts in this country has been strangely overlooked, may be attributed to our slowness in adopting improvements, the benefits of which are not forcibly presented to us: fine and hollow bows we adopted instanter, because to us the improvement was visible, we could see the effect in the displacement of the water about the bows of

a bluff and a fine lined cutter when sailed together, and the advantage obtained in point of speed was palpable to our senses; but the advantages obtained by reducing the weight of spars, are not so immediately or strikingly visible, they require to be studied in detail, and under varieties of wind and sea, and the circumstances under which a vessel may be placed, to be properly understood and appreciated; and it is the study of these details, that, like many others in yacht building and sailing, we have not, up to the present, devoted sufficient care and attention to.

The great end to be achieved in the rigging and fitting of a yacht, indeed for speed, combined with sea-going ability, is to have every particle of weight above the water-line reduced to a minimum, and yet a proper strength retained: the bulwarks, channels, chain plates, hatchways, skylights, companions, windlass, bitts, levels, and deck transoms, come under this head of reduction; then follow the spars, and the standing and running rigging, every ounce of unnecessary weight aloft is injurious to a vessel's performance, whether it be in light or heavy weather, and until we succeed in reducing much of our present cumbrous fittings, we shall not have approached perfection. That the American yachtsmen and builders are fully alive to this important fact we have abundant proof; I may instance the America, the Maria sloop, the Charter Oak, and the Christopher Columbus; their little sloops too, such as the Truant and Una; and their pilot boats, the Mary Taylor and the Moses Grinnell. If we go beyond these let us look at some of the Yankee clippers that make their appearance in the Mersey; for the amount of canvas spread and materials used in spreading it, the economy and lightness of the latter is very striking. It may be said that we have heard enough and to spare, about Brother Jonathan and his naval architecture; about his yacht America, and his Truant's and Una's; his famous pilot clippers, his magnificent fleet of ships, barques and schooners, that daily crowd the second sea port of our empire; and the proverb, *mus in pice*, may possibly be applied to the writer who continues to ventilate such an apparently thread-bare subject, he may be taunted with spinning the thread of his verbosity finer than the staple of his argument; but nevertheless the staple is there, an ugly fact which remains, by us, unrivalled; and until we make the warp and woof thoroughly harmonize, the thread of verbosity will continue to be spun by all "skipper pens," whose aspirations are to see our yacht fleet

what it should be, what we have the intelligence, the skill, and the capital to make it, the finest, the handsomest, and the fastest in the world. We have not been too proud to adopt two hints from Uncle Sam, we have revolutionized the hulls of our vessels, and the canvas; we must go one step farther and improve our sparring and rigging, and get rid of much that is cumbrous and useless; wire rigging has taken the initiative in this reform, and our spars must next be looked after.

The Yankee sloop, the Maria, was fitted with a hollow boom 100ft. long: irrespective of the difficulty of getting a solid spar of such dimensions, the enormous weight would have been almost enough to shake her hull seriously in rough water, let alone the strain upon her mast: but Messrs. Fish and Morton met this difficulty by building both a boom and a bowsprit, and if such an enormous spar could be achieved successfully by trans-atlantic spar makers, is it not reasonable to suppose that in this country, where the skill of our shipwright artizan is proverbial, something far superior may be produced. It appears to me strange that the advantages of this invention have not borne fruit here long 'ere this; it would seem only to require some one yachtsman or builder to place a proper design in the hands of the workmen and the thing would be done and well done. The first step towards obtaining these hollow spars in America appears to have been the boring out of solid sticks: the America's bowsprit was bored out from end to end; but the Maria's boom was built with staves and hooped together with wedge key mortice loops of iron, the cost of making it was 600 dollars. The boom made for the Ultra by the same makers, was 74ft. long, 15in. in diameter at the slings, and reduced to 8in. at the ends; this boom was made upon a different plan: a solid stick of white pine was first shaped to the size required, it was then sawn likewise down the centre, and the interior of the spar gouged out, leaving only an external shell of 2in. in thickness: both sides were then left to season and dry out well, and when time sufficient to develope any shakes or sappy spots had elapsed, both sides were then hooped together with wedge key mortice loops placed five feet apart; these loops could be set up to any tightness by the wedge keys, and thus this shell spar was put together as firmly as it had originally grown: to obviate the longitudinal working of both these sides, when the boom should buckle from the strain of the mainsail, augar holes of an inch in diameter were bored in the seams of the spar, at a distance of six inches from every

second loop, and treenails driven in. The materials and labour for this boom cost about 100 dollars, and when finished, competent authorities to whom it was submitted pronounced it to be the strongest and lightest boom of its proportions, they had ever seen. The judgment of experienced men in America pronounce hollow spars to be far superior to solid ones: of this however we should satisfy ourselves; a few practical experiments would speedily settle the question, and the expense would be comparatively trifling. If we once satisfy ourselves that strength sufficient for our seas can be combined with the great lightness thus obtained, I have no doubt that improvements in both would speedily follow; and I cannot see any reason to doubt that if we accomplished hollow booms and bowsprits, that masts could not be built as equally strong and light: what a triumph this would be, to get rid of such hampering weight as we are at present compelled to carry, and to see our splendid clippers spreading the framework of their snowy wings upon sticks, which, comparatively speaking, would be lighter and stronger, than the bones of a sea-gull's wing.

I do hope that the attention of yachtsmen and builders will be directed to the building of spars, and that the subject will not be neglected. In the fitting out of large yachts, what difficulties have not been experienced in obtaining handsome and good spars: with small vessels it is a matter easier of accomplishment, and propably in our third and fourth class vessels, the built spars might not be found capable of competition with the sold sticks: this, however, as with the larger vessels, quite depends upon experiment; but where a spar can be effectively built, where every component part can be selected free of knot or shake, sap or rind-gall, I am sanguine enough to think that something very superior could be produced from the hands of British spar makers.

Let no incredulous individual pooh-pooh at the idea of a yacht sailing under a crop of what may be called "artificial sticks," if he does his incredulity will undergo a severe test at the hands of American invention;—some time since we were informed that boats were about to be, or actually were, being built by steam in New York; it was said that two or three trees of the different woods required were put in at one end of this wonderful machine, and that a fleet of boats were dropped out at the other. Plaster-of-Paris sugar loaves, wooden nutmegs, and hickory oats, were quoted as proof of the fertility of Jonathan's genius, and the value of boat-building machinery was estimated

at par with the above named curiosities of Yankee origim; but it turns out that there is really more method in its inventor's madness than we were disposed to give him credit for, and Mr. Wathon Thompson, of New York came amongst us, astounding Princes of the blood Royal, driving Lords of the Admiralty crazy, taking bluff old Admirals all aback, and setting the brain of a Scott Russell agog, to see how the wave-line will be produced under the manipulation of iron instead of human flesh and blood; it is a fact that the boat-building machine is actually located in the City of London, and according to the high and mighty authorities aforesaid—one of the wonders of the age.

"Chip's" occupation is gone; adze, axe, and maul will henceforth rank amongst the things that have been, and may be hung up in festoons around the old mail coaches; floorings and futtocks, keels, stems, and stern-posts; planking and sheeting, all are child's play to this monster steamwright's "drunken saws, invisible planes, diagonal cutters, and irregular bevils"; a yachtsman may contemplate building a new craft at breakfast, and she will be ready for him to dine on board of at an early hour.

In sober *parlance* however, this boat-building by Mr. Wathon Thomson's steam machine, is very ingenious; at present its functions appear to be confined to ship's boats, or small yachts, but bye-and-bye we shall see merchant clippers and mighty ships of war claim steam as their progenitor.

Those, therefore, who are inclined to doubt the practibilily of building hollow spars, that shall be stronger and lighter, and more suitable to yachts, than the solid sticks as used at present, had better pay a visit to Mr. Thompson's factory, and perhaps their doubts may be dispelled as quickly as his wonderful steam planes make the shavings fly.

## CHAPTER XXI.

"Should they, though reefed, again their sails extend,
Again in shivering streamers they may rend;
Or should the masts stand beneath oppressive strain,
The down-pressed ship may never rise again."—FALCONER.

WE now come to the gaff, and in treating of this spar it may be said that no matter how excellent the main boom is, if the gaff is bad the mainsail can never be set properly; therefore, in the choosing of a stick for this purpose, well-seasoned, close grained timber, free from knots, sap, or rind gall, is of much importance. The lighter it can be made the better, but at the same time a due regard must be had to producing a stiff stick, for if a gaff buckles at all when the mainsail is hoisted, the after part of the sail will be all in a bag; this more particularly, applies to square-headed sails; and to remedy the buckling of a light gaff with such a sail, the peak halliard blocks are placed well out upon the spar; this will take up the after leech, but then the gaff will spring between the peak blocks and the throat halliards, and the belly of the sail becomes slack, so that a weak gaff will never properly set a square-headed mainsail. With this shaped mainsail, therefore, a strong spar is necessary, and to obtain the requisite strength there must be additional timber; consequently a sail cut thus necessitates a heavy gaff, and involves extra top-hamper.

A sail cut with a high peak can be set with a lighter spar, and moreover, by placing the peak halliard blocks well out, it can be tapered up more considerably and rendered much lighter still.

The length of a gaff of course altogether depends upon the dimensions of the sail to be bent upon it, but care should be taken at the outset that it is cut sufficiently long to take out the head of the sail as it stretches; nothing requires watching more than the head of the mainsail, not a wrinkle should be permitted in it, and in a racing yacht particularly the lacing should be overhauled, and the peak earing hauled out, upon every occasion that the least slackness of the head of the sail is perceptible; if the gaff be not cut long enough this cannot be

done, and if the head of the mainsail is suffered to remain so, what may be a good sail is but half bent.

I have so frequently alluded to high peaked mainsails that I fear I shall incur the charge of tautology in again referring to them in connection with the subject of gaffs; but as the construction of these spars is materially influenced by the shape of the sail which is to be bent upon them, I need scarcely plead any apology for doing so; a square-headed sail will, as I before stated, require a stouter spar to set it than a sail with a great peak, and the less weight we can have aloft the better. This is one argument in favour of a peaked sail; but there are others far more important; a square-headed mainsail can never be set to the same advantage when a vessel is close hauled upon a wind as one cut with a lofty peak, for the gaff of the former will always be found to form a very considerable angle with the boom, and the best efforts of the head of the sail in propelling a vessel is lost; whereas the gaff of the latter, if the sail be well cut, will be seen to lie nearly in the same place as the boom: moreover, the square-headed sail is more likely to drag on a vessel, and depress her quarters when she careens to a strong breeze, than the peaked sail, the latter throwing the weight of the canvas more into the body of the vessel. With a lofty peak to the mainsail, a shorter mainmast will spread an equal amount of canvas with more advantage than a longer mast and the sail square-headed, and the comfort of snug spars in either a cruising or racing vessel cannot be over-estimated.

The jaws of gaffs may be made of either wood or iron, where it is much peaked iron commands a preference, and another advantage iron presents over wooden jaws is that when running off a wind with the mainsheet well eased out, wooden jaws get jammed against the eyes of the rigging, and with the first little jump of a sea away goes the gaff short off like a carrot, whereas iron jaws not requiring such a great thickness at the throat, fit neatly and snugly round the mast, the horns slide in under the rigging, and thus prevents the latter becoming a fulcrum whereupon to carry away the gaff.

Whether iron or wood be used for the jaws, the gaff should always be fitted with a good solid wooden tumbler, playing easily in a strong pin between them; no gaff is complete without this tumbler, it always lies parallel with the mast, reduces the strain upon the jaws, prevents the gaff getting jammed against the mast, eases the strain on the parral

rope, prevents the jaws chafing and cutting into the masts, and ensures the perfect travelling of the gaff up and down the mast. Sometimes gaffs have iron straps driven on them for the peak halliard blocks to hook into; this is a bad plan, for in driving on those iron straps, or even if they are span screw straps, they tend to crush that part of the spar immediately under them, and a little working increases the evil, so that the gaff is easily sprung or carried away in their immediate vicinity; selvagee straps covered with leather and retained in their positions by stop cleats nailed upon the under part of the gaff, are the proper fittings for this purpose. I have seen galvanized wire straps covered with leather used for the same purpose, as also for mainsheet block and jib-halliard block straps, and a very excellent fine job they make, particularly for mainsheet block straps.

The cheek blocks at the end of the gaff for the topsail sheets to reeve through require looking after, in order that a sheave suitable to the sized rope used for the sheets may be used, and that the shell of the block be well and firmly rivetted to the spar. I have seen many awkward incidents and ugly accidents occur owing to negligent workmanship in this respect; two I will mention in illustration. The first occurred at the close of a hardly contested match, a heavy squall struck us and we immediately sprung to take in the gaff-topsail, the outer end of the shell of the cheek block was started from the gaff, the sheet got jammed between it and the spar, and we could neither get the topsail down nor set it again, and were so hampered by it as to very nearly cause us to lose our well fought match. The second instance was where the sheet was too large for the sheave, and when we got the topsail up (being under way at the time with a jump of a sea on), the sheet jammed, and we could not sheet the topsail home; the sheet then took a round turn over the gaff end, I went up to clear it as well as to render the sheet through the sheave, the helmsman gave the vessel a slight shake up to assist me, which by the way he should not have done; and I managed very cleverly to pierce myself in the calf of my leg with the hook of the outer peak halliard block during my endeavours to prevent myself being shaken off the gaff end.

Sometimes the sheave is let into the spar when the latter is stout enough, but as this tends to weaken it, the cheek blocks are more generally used.

A neat copper band at the end of the gaff makes a good finish, and

the ensign halliard, or jewel block, for the peak downhaul, should be strapped with copper, having a stout copper eye bolt with a good shoulder upon it, to be driven firmly into the gaff end; this block should be made to take an 1¼ inch or 1⅜ inch line, for a good heavy drag is sometimes required to get the peak down in a hurry, and a light downhaul is next to useless; the line used for this purpose should be "plaited" and not "laid." As the downhaul answers for ensign halliards as well, I may here remark that all signal halliards and the back lines for signals themselves, should always be of plaited material; for a laid line generally twists, and very often, when an ensign, or flight of signals is sent aloft, immediately when broken out it is discovered that the flags are twisted round the halliard or back lines, after a fashion rendering them quite indistinguishable.

The nock bolts and pin under the throat of the gaff, which take the "nock" or "throat" of the mainsail, should be of good workmanship and strong, and well galvanized; the topsail sheet fall block and the main-tack tricing-line block, also attached to eye-bolts under the throat of the gaff should undergo a close inspection that they are full sized for the ropes, and that the sheaves work smoothly and well; the peak halliard and lower main halliard blocks, should also be attended to; the lower main halliard block should be attached to the gaff by a broad galvanized iron plate passing down through, and playing freely in a score cut for the purpose between the jaws, and this plate should be secured by a cross pin passing transversely under the jaws of the gaff; these latter, when made of iron, sometimes have the eyes for blocks, nock pin, and block plate, forged in the solid, it makes a very neat and strong finish, and prevents the wood of the throat being so much cut up by a number of bolts passing through it. Iron jaws should always be neatly covered with leather, everything connected with a gaff, the material used and the blocks and fittings thereof should be of the best description and careful workmanship, and it should work upon the mast as easily and freely as though it were moved by a cog wheel; an easy working gaff is half the battle when a vessel has to be worked smartly in heavy weather, and the way to ensure this is by strict attention to the details I have endeavoured to enumerate.

Every practical yachtsman knows that when reefing a mainsail by the wind or running free, the canvas blows about wildly and often gets foul against the lifts and rigging; if then to this difficulty, which has

frequently to be overcome by downright man-handling, there be added a stiff working gaff that jams on the mast, blocks through which the halliards won't render, and a downhaul of no more service than a pack thread, it becomes a very awkward business indeed, and in a racing yacht is sure to end in defeat. Often when a squall of more than ordinary weight strikes a vessel it becomes necessary to run off before the wind, and relieve her by "scandalizing" (*i.e.*, lowering) the peak of the mainsail and tricing up the main-tack, and not unfrequently it is of the last importance to close reef her and shift her head canvas whilst in this position, or perhaps to stow the mainsail altogether and set the storm trysail. A heavy sea may nearly always be expected to accompany such weather, and the men have not a very steady platform beneath their feet, in fact the little craft is bounding about like a wild colt, and it requires a little of Astley's circus training to remain firm on one's pins, and at the same time effectively to use the arms. Under such circumstances rapid handling is indispensable, but the best men that ever trod a plank may be beaten and wearied out by bad fittings and refractory gear aloft, and I don't know any part of a yacht's rigging or spars more calculated seriously to impede quick and good handling than a badly fitted weak gaff.

In connection with the gaff must be taken into account the hoops of the mainsail which confine it to the mast; if these hoops are too large, although they will run freely, yet there is a great space lost between the sail and the mast, and the loss of propelling power follows; if they are made too light they will not travel kindly, no matter how well the mast may be greased, so that a little nice discrimination is necessary in proportioning them, as they will much effect the free working of the gaff, more particularly with a new sail. Iron hoops well leathered make a very excellent job, but here, too, experience becomes necessary, as if the proper substance of iron is not put in the hoops they will bend, the distance between the mainsail and the mast will be greater than in the wooden hoops, and they will jam even more. Iron hoops should be galvanized before they are covered.

From what I have said relative to the main-gaff it will be evident that the trysail-gaff requires an equal amount of careful attention; the trysail and its fittings should be the yachtman's principal care after completing his fine weather rigging and canvas. There exists an unaccountable laxity amongst yachtsmen generally with respect to storm canvas;

whether this arises from the belief in the old adage that "it is time enough to bid the dusky gentleman good morning when you meet him," or from too great a faith in a vessel's powers under her ordinary canvas, it is hard to say; but how often do we see the trysail-gaff securely lashed on the top of the boom, and the trysail stowed away in the lowermost depths of the sail room: when the stormy hour is at hand the mainsail is close reefed, and the vessel sent staggering along through a mountainous sea, the weight of her boom overpowering and pinning her down in the lee roll until her decks are swept again, her lee bulwarks carrying tons of water on the deck, and everything is confusion, then comes the order to take in the mainsail and set the trysail; the trysail gaff has to be cut loose and laid upon the deck to be knocked about like a nine pin, and to inflict sundry barkings on the shins of the foremost Jacks in their endeavours to secure it; then sundry topsails and jibs have to be bundled out of the sail-room upon the wet deck to arrive at the whereabouts of the trysail; back go the sails again, dirty and wet. Next the head lacing is astray or the mast lacing; the jaw parral has to be looked for and perhaps cannot be found: the trysail sheets next are missing, another overhaul of the sail locker gives another and more thorough wetting to the sails that should be kept dry, but no sheets are forthcoming; a general search now ensues, and at the eleventh hour they may be hauled out of some secluded nook in the fore peak, where they had been stowed upon the principal of the Dutch school of anchors. Eventually when the much needed trysail is ready to set, the hurricane is upon the devoted little barkie in all its fury; there is no time to think of shifting canvas, all hands must hold on the best way they can, and the skipper and mate have quite enough to do to keep the little ship living and free of water.

That this state of things has often occurred few will gainsay, that it should occur may be principally attributed to the too prevalent desire of making a yacht all wings, and never reversing the fine weather picture until the raging elements impart a lesson that once learned will never be forgotten. The trysail-gaff, therefore, should be as sharply looked after as the main-gaff; instead of being lashed upon the boom it should be kept laced to its sail; the jaw parral should be in its place ready for bending, the sheets should be attached to the sail, instead of lacing to go round the mast (and which lacing, by the way, very often fouls or blows away when the sail is being set), there should be neat selvagee

strops covered with leather and fitted with eyes and toggles, seized along the luff of the sail, similar to hoops; then gaff, sail, sheets, parral, toggles, and all complete should be neatly stowed in a painted canvas cover, which may be slung under the boom, or lashed on top of it, or lashed with the topsail yards on deck, uppermost and at hand always. Prepared for the worst after this fashion, when a falling barometer indicates the coming storm, there is no trouble but to stow the mainsail at once, uncase the trysail and it can be got upon the little ship in as short a time as I take to write these lines.

No yacht, be she racer or cruiser, should ever go to sea without a trysail; under this sail, with a spit-fire jib and close reefed or storm fore-sail, she must be a sorry craft indeed that will not carry her crew dry and comfortable through the day or night of storm; and any yachtsman who suffers from a neglect of such simple precautions fully deserves all that may befall him in the shape of anxiety, knocking about, wet, discomfort, and wearying fatigue. How much pleasanter it is when caught by a gale to turn in below, confident in the storm trim of the ship, and secure in the skill of a tried captain and experienced crew, than to be dodging the green water on deck and watching with feverish restlessness every movement of the straining craft, imagining at one moment that she is going to turn turtle, or the next that the boom is going to twist the mast out of her; or perhaps if she is running before the wind, and the helmsman is over-mastered by the fiercely following sea, the leach of the mainsail gives one flap, over goes the boom with a crash that knocks everybody off their feet, shakes the wee barkie until every plank in her quivers again; away goes what was the weather runner with a report like a howitzer; the mainsheet parts like a hay band, and it is ten to one that the mast does not dissolve partnership and pay a visit "over the side." These are some few of the *agremens* of trusting a vessel under her large mainsail and boom during stormy weather. "Lead, Log, and Look out" is a maxim that should never be lost sight of by a sailor, and to the adventurous yachtsman who cruises about our wild channels, for wild they are very often, I would say add "Trysail," it is the best port for a wandering cruiser, when he cannot find a convenient spot to let go his mud hook in.

The cro'-jack, cross-jack, or more properly the square-sail yard, is now rarely seen with our racing cutters; but our cruising vessels find them useful. The square-sail yard crossed when a yacht is lying at her

moorings gives her an imposing look, and when she is dressed in her holiday bunting vastly adds to her appearance ; but if the anchorage be crowded it is an intolerable nuisance, for very often other yachts when coming to their moorings, or in swingiug to a change of wind, get foul of the square yard, and then a regular smash ensues. To avoid this under such circumstances the yard must be carried "a-cock-bill," that is the starboard arm topped up, the yard being hoisted the depth of the arm from the deck, and lying nearly up and down with the mast. A good tough stick is requisite for this spar, and the braces, halliards, sheets, and guys, and yard ropes, with their respective blocks and sheaves should be carefully fitted so as to ensure rapidity and certainty in working.

In a cruising vessel a squaresail will be found extremely serviceable with a favourable breeze when making passages, and drags a vessel along in grand style. As cruising yachts seldom carry balloon canvas, a square-sail may therefore, be considered as very necessary. With a racing craft, however, it is otherwise, her balloon topsail yard and balloon topsail will be found to answer all the purposes of a square-sail yard and square-sail; and she has plenty of lumber in the shape of spare topsails and yards without encumbering herself uselessly with a spar and sail that would be more in the way than otherwise.

## CHAPTER XXII.

"And though 'twas not much to a naval mind,
Some landsmen would have looked a little pale,
For sailors are in fact a different kind:
At sunset they began to take in sail,
For the sky showed it would come on to blow,
And carry away, perhaps, a mast or so."—BYRON.

THE gaff-topsail yards will finish my enumeration of spars. As much of the proportions of these yards depend upon the cut and shape of the gaff topsails, incidental to this branch of our subject, I must introduce somewhat relating to the sails themselves:—A square-headed gaff-topsail is now pretty generally admitted by all experienced yachtsmen to be next to useless when a vessel is close-hauled on a wind; running off a wind, or with the wind abeam it does very well; but once come to touch its luff in the slightest degree, and the sooner it is down on deck the better; the evil produced by a shaking topsail during a race is in nine cases out of ten overlooked by the generality of sailing masters; the moment an inch of canvas begins to shake, that portion of the sail is perfectly useless; it is hardly necessary, therefore, to say that when the whole of a sail begins to shake, it becomes worse than useless, for it is productive of serious injury to a vessel's speed; it becomes a wind draught that resolves itself into a drag of no mean magnitude, and whilst the three lower sails of a cutter may be performing their part to admiration, the badly cut and badly fitting gaff-topsail, shaking aloft, may, and almost certainly will, be undoing half their good work.

A square-headed gaff topsail will take a heavy stiff topsail yard to set it properly, and this additional weight aloft is necessitated by this form of sail; if we add to this the difficulty that is very often experienced in taking in this description of sail, as it frequently flies away to leeward, and defies the efforts of the clew-line to restrain it, we may sum up the prominent disadvantages of a square-headed gaff topsail.

With a gaff-top sail cut with a high peak, that is, having the topsail yard nearly up and down with the topmast, the case is widely different.

Such a formed sail will stand by the wind to the last moment, the same as a well-cut mainsail; the yard being up and down tends to set the sail at as nearly as possible the same angle as the mainsail, and if a gaff-topsail-peak-halliard of light line be used with the yard, and a bowline to the luff, the sail can be set to perfection.

Another point I would draw attention to in the setting of this sail:—when the tack is to leeward, a certain portion of the propelling power of the sail becomes less effective; a vessel will be generally found to perform better under her four sails when the tack of the gaff-topsail is to windward; now with a high-peak gaff-topsail, the tack can, by a simple arrangement of very little additional gear be always set to windward; the arrangement of this I would suggest as follows:—the gaff-topsail yard should have its lower arm cut to clear the masthead about a foot or eighteen inches, a double tripping-line should be attached to the end of the yard, rove through two cheek blocks placed well out upon the gaff, and then down through two jewel blocks under the throat; two other tripping-lines should be bent to the tack thimble, and the falls led down on deck over and upon each side of the peak halliards; then when a vessel tacks, and just as she is head to wind the tack should be let go, the tack tripping-line hauled on until the tack is hoisted over the peak halliards; then when the tack is being hauled down, the gaff-topsail yard weather tripping-line should be hauled out until the end of the yard clears the mast, when it will spring out to windward, the topsail tack may be hove well down by the tackle, and the sail becomes set to windward as before. It will greatly facilitate this manœuvre if the topsail sheet be started an inch or so until the tack is hove down again; but in many instances, and particularly in light weather, this proceeding may not be necessary. In very short tacks it may not be considered expedient to touch the topsail tack, or shift it to windward, but in beating to windward on long tacks the great advantages accruing from the shifting of the topsail tack to the weather side of the mainsail, will, I think, be sufficiently obvious to the practical yachtsman.

The yards for high-peaked gaff-topsails can be made lighter than those for square-headed topsails, and this is in itself a great advantage as lessening the weight to be carried aloft. I have seen some such spars made very light indeed, and then strengthened by a hardwood batten nailed to the underside; these make very good and serviceable spars, and by thus lessening their size a good deal of wind-draught is

got rid of, whilst the hard wood supplies the deficiency of strength which the reduction of timber may occasion; the great object in all spars used aloft is to get them made of the smallest possible substance. Let any yachtsman take the weather signal halliards in his hand when a vessel is under full way, and he will speedily become convinced of the tremendous wind-draught produced by even so small a diameter as the line of a signal halliard. What then must it be with a gaff-topsail yard such as we now see used in our racing cutters. Many of our cunning sailing masters of the present day, quite alive to all such minutiæ, and aware that not a chance affording the slightest prospect of success can be thrown away, unreeve their signal halliards, and nail their racing flags to the topmast.

It is a strict attention to all such details, which taken individually, may appear of but trivial consequence, but in the aggregate are productive of the most injurious results, that constitutes perfection in a racing sailor; and if such apparently small substances as the light lines of which signal halliards are composed render their removal requisite to avoid injury to speed, how much more should we pay attention to the construction of such very much heavier and more solid substances, that offer a loftier and more exposed surface to the action of the wind.

A racing cutter will be fitted with four gaff-topsails, viz., a jib-headed or ring-tail topsail that is set without a yard, by lacing it to the topmast as it is hoisted; in blowing fresh weather, and particularly in beating to windward, this is the best topsail that can be set; if well cut, it will stand as well as the mainsail, and I have often seen such a sail that stood better; it is a sail that can be carried, when a gaff-topsail with a yard cannot; it is easily set, and as easily taken in, and can oftentimes be used with advantage over a reefed mainsail, particularly in the intervals of squally weather; the tack of this should be fitted with tripping-lines such as I have described for shifting it to windward, but from the absence of a topsail yard, the yard lines are unnecessary; it is a great advantage in this sail to have the luff fitted with straps and toggles similar to those I have indicated for the storm trysail; they will be found to work much better and handier than the usual system of lacing. In bending on the clew-line of this and all other gaff-topsails, there exists a faulty plan with some sailing-masters; they lash a small block to the topsail yard just about the slings; reeve the clew-line through this, and make the standing part fast to the clew thimble; under this

arrangement the sail, when necessity arises, can be but half clewed up, for the clew can only be brought chock up to the block upon the yard, consequently the belly of the topsail is left flying about, and very often becoming inflated with a puff of wind as the sail is being hauled down, causes it to blow over the peak halliards or away to leeward. A sail when clewed up should be done in such a manner as to spill all the wind out of the sail, thus precluding the possibility of its overpowering the hands on deck; to do this effectually the block should be lashed to the lower end of the topsail yard, and not at the slings as is usual, the standing part of the clew line should be made fast at the same place, but should lead on the opposite side of the sail; then it should be rove through the clew thimble and back down through the block; by this arrangement, when it becomes requisite to clew up the sail, the clew line braces all the canvas taut up to the yard, and leading through the block at the end of the yard, the strain upon it tends to bring the latter up and down with the mast, and much facilitates the getting of the sail down upon deck. I have never seen a jack yard used with a jib-headed gaff-topsail, but it is not quite clear to me that it might not be with advantage.

As some yachtsman, not deeply versed in racing lore, may not be aware of what a jack yard and its uses are, I may be permitted to offer them an explanation: some vessels that carry short main-gaffs, and vessels with high peaked mainsails especially, cannot get sufficient width to the foot of their gaff-topsails; to remedy this the topsail is cut much wider at the clew than the gaff will set it. A short yard, called a jack yard, is laced to about a third, or more if requisite, of the foot of the sail, the topsail sheet is bent to the middle of this yard, and when the sail is set, it projects with the yard much beyond the gaff end. As I have stated, I do not see why a jack yard could not be used as effectually with a jib-headed topsail as with any other, if the additional canvas should be considered requisite.

The next topsail will be No. 2, or the ordinary working gaff-topsail; if this be cut with a high peak, a light yard can be used; the tripping lines I have alluded to should both be fitted to this yard and sail; I think it would be found of very great utility if the bolt rope upon the heads and luffs of gaff-topsails cut with a high peak was put on of a larger size than it is at present; my reasons for so thinking are, that in those sails the great strain in setting them properly comes upon the

head and the luff; if the bolt rope of the head were made stronger, when it came to be stretched along the yard, and then seized to it with knittles, I think it would strengthen the yard considerably; and carrying this strength in greater proportion down to the luff rope, there would not be so much likelihood of wrenching the tack of the sail out of shape, and the yard would be held more firmly at its proper angle by the topsail tack pennant and tackle; as it is, accordingly as the sail becomes stretched along the head, and the bolt rope yields, the knittles or lacing becomes slack, and the whole weight of the sail is thrown upon the yard; and if the luff rope stretches also, the foot and tack of the sail become wrenched out of form, and the whole sail more or less injured after a few races or cruises; but with the head and luff rope of a greater proportional strength than they are at present applied, and well stretched before being sewed upon the sail, it will be found to preserve its shape and to set better, and as the head of a sail with a high peak will form but a very small angle in a right line with the luff, by stretching the head well along the yard, and seizing it firmly by lacing or knittles, the head and luff when well hove taut by the tack tackle will strengthen the yard, take slack canvas out, preserve its shape, and the sail will set as flat as a board.

The third topsail in order will be No. 1, or the large working topsail which will be generally used in fair upright weather; and the observations I have made relative to the two previous sails will generally apply to it; the yard for this sail will be longer than that for No. 2, and here the hard wood batten will come into operation; the yard itself should be a clean grown close grained piece of timber, and entirely free from knots, at least of any magnitude, for whenever there are large knots, there the yard will be safe to go.

The fourth topsail is not general designated by number, but is known as the "balloon or large racing topsail;" the yard of this topsail is generally a swinging stick, of large diameter in the slings, and consequently involving a proportional weight of timber; this spar may however be considerably lightened by the proper application of a hard wood batten, large about the slings, and tapering away to nothing at the ends; instead of having this batten nailed upon the yard, which mode of fastening weakens both it and the spar, it is much better to have it seized on with round seizings, hove well taut with a serving mallet or marlinspike. Of late years nearly all the balloon topsails are fitted with

a jack yard at the clew, running well in on the foot of the sail; the yard and tack tripping-lines will be found particularly useful when fitted to a topsail of this description, not however for the same purpose as they are fitted to the other topsails, namely for working it when close hauled; the balloon topsail is generally used for running off the wind, with the wind quartering or abeam; but a balloon topsail should never be carried with the wind before the beam; a point or two before the beam may be admissable sometimes, but not one in ten such topsails will stand when a vessel is close hauled; and even if one does, it alters the trim and position of the centre of effort of the sails so much as to cause the necessity of applying a strong weather helm to the vessel, that is if the four ordinary working sails are properly proportioned, and their common centre of effort rightly determined; for the great extra quantity of sail spread and carried further aft by the jack yard, brings the centre of effort of this sail so much further aft as to cause the balance of canvas to be seriously disturbed, and a vessel cannot be sailing at her best when the helm is right across her deck; these two points must therefore be held in remembrance amongst cutter sailors; first, that a balloon topsail can rarely be got to stand flat upon a wind; and secondly, that if it does, the balance of canvas with respect to the centre of vertical longitudinal resistance is destroyed, the pressure aft being so much greater as to require a strong weather helm to counteract it; and although a vessel may to all appearance be moving fast through the water, it is but a struggle betwen the canvas and the rudder to keep her on her course.

I make these remarks from close personal observations; that there may be exceptions I have no doubt, but as a general rule I never saw a vessel perform so well under a balloon topsail when close hauled, as with a jib-head or small working topsail. I have seen a balloon jib carried at the same time, and it might be supposed that this would restore the balance of sail; but almost invariably I have observed that balloon sails carried on a wind entailed defeat, and oftentimes at the most critical period of a match when a little prudent foresight and smart handling would have insured success.

The use of the tripping-lines fitted to a balloon topsail will be found in getting the tack to windward when it becomes necessary to jibe the boom over in running; the tack to windward prevents the whole strain and weight of the sail and yard being thrown upon the topmast; any

yachtsman who has observed the way in which a topmast will buckle and bend forward when the tack is to leeward of the mainsail will readily understand this, and if a sail is permitted thus to belly out and drag the topmast over a vessel's bows, she will then bury by the head, even though the topmast be steadied by a backstay; but with the tack kept always to windward the centre of effort of the sail is kept in its proper place, and acting more in unison with the mainsail; another principal advantage is, that when running down upon a flag-boat round which it is necessary to brace sharp up upon a wind, or that the wind becomes too heavy to admit of carrying the topsail any longer, it becomes necessary to get it down smartly; very often it must be carried to the last moment in order to clear a ruck of vessels, and a mistake in handling it might throw away a vessel's chance. To get a topsail of such dimensions as are now carried down to leeward could not be attempted; and, therefore, if the tack be to leeward, it must be got to windward; this can be done instantaneously by the tripping-lines, and once over, down comes the topsail at any time without trouble; smart hands I need hardly say can accomplish this without the aid of tripping-lines, but they will much ensure and aid the smartness of the manœuvre.

The last item of the spars I shall allude to is the cross-trees; in the fitting of cross-trees, although apparently very simple, there are some points requiring particular attention; in the first place, the timber of which a cross-tree is composed, must be picked for its toughness, and a certain amount of elasticity; it should in length nearly equal the beam of the vessel, for a good spread to the topmast rigging is most essential; the topmast shrouds should be led down, and the shroud tackle bolts placed in the channels, so that the strain of the shrouds may come exactly fair with the centre of the topmast; the cross-tree should exactly correspond at the ends with this strain, and it is often necessary to have it of a considerable horizontal curvature to attain this; but if this point is not attended to strictly, the first undue strain that may happen to be put upon the cross-tree by the topmast, and that strain, if it takes effect at an angle with the tree, either before or abaft, it will assuredly wrench and carry it away, and once it goes, nothing but a sharp application of the tiller will save the topmast.

In addition to the correspondence of the ends with the strain of the rigging, it is of the last importance that the cross-tree should be fitted in the lower cap, outside of the forestay, so that it can be easily removed

and got down upon deck; in heavy weather when the topmast is got upon deck, everything connected with it, save the rigging, should be got down too; and the weight of a cross-tree, though it looks small when aloft, yet considerably relieves a vessel when taken down; it is not immediately the substantive weight, although that is very often of no inconsiderable amount, as the action of the wind upon it, for everything that the wind catches, and which is of no use in propelling the vessel, becomes an injury to her, and nothing can be more hurtful than useless and unnecessary weight about the masthead.

The fitting of the topmast rigging into the scores at the cross-tree ends requires attention; the outer shroud is fitted into score cut into the end of the tree to receive it, and it should be kept in its place by a galvanized iron pin attached to the tree by a small lanyard; the inner shroud fits in a cleat rivetted on the after side of the tree, and these cleats may with advantage be made of galvanized iron, with the throat rounded like a thimble, and presenting a good broad surface, so that the shrouds, whether of hemp or wire, may rest firmly against them, and not have too short or narrow a nip upon them, as should this be the case, the shrouds will have a tendency to strain and snap at these points; these cleats should also have galvanized pins to prevent the shrouds flying out of them on the lee side; and the scores should present an even easy surface for the rope to work and render upon, so as to prevent chafing, and facilitate the housing of the topmast.

Lastly, I would call attention to the great advantage accruing from having the topmast fitted with a traveller, or using a parral when setting topsails; it keeps the yards close to the mast, takes much unnecessary strain off the topsail tye, and prevents the yard and sail flying away to leeward, when it may be requisite to strike them suddenly.

## CHAPTER XXIII.

"The order given, up-springing with a bound
They fix the bars and heave the windlass round,
At every turn the clanging pauls resound;
Up-torn reluctant from its oozy cave,
The ponderous anchor rises o'er the wave."—FALCONER.

THE ground tackle of a yacht will, of course, much depend upon her size; but it should be selected with the utmost care and attention. It will not do to have a lot of anchors and chain cables and hawsers sent on board, and bent or stowed away just because they happen to be in the shape of the articles required; a due regard should be had in the first place to the proper weights and substances, so that we may not be either uselessly encumbering the ship with unnecessary weight, or finding ourselves in the moment of peril with anchors that will come home, or chain cables that will snap; and in the second place to the workmanship, so that our care in the selection of sizes may not be thrown away by overlooking faulty handicraft.

For the two classes of vessels that I have primarily treated about in these chapters—namely 25 and 50 ton cutters, I will recapitulate what appears to me the necessary ground tackle. For a 25-ton cutter; one to be best, or bower anchor of from $2\frac{1}{2}$ to 3cwt.; one second or working anchor of 2cwt., and a kedge anchor of $\frac{3}{4}$ to 1cwt. One chain cable of 60 fathoms made of from $\frac{3}{8}$ to $\frac{7}{16}$in. to $\frac{9}{16}$in. link, and one hempen hawser of from 3 to 4in. rope. For a 50-ton cutter, one best, or bower anchor of from $3\frac{1}{2}$ to 4cwt., one second or working anchor of 3cwt., and one kedge anchor of from 1 to 2cwt. A chain cable of 90 fathoms made of from $\frac{1}{2}$in. to $\frac{9}{16}$ to $\frac{5}{8}$ link; and a hempen hawser of from 4 to 5in. rope.

I here insert some tables that may be found useful to yachtsmen when considering the subject of ground tackle.

TABLE I.—Shows the proof strain applied to anchors, such as Rodger's, Porter's, Admiralty, and others, in the Dockyards.

| Anchor. | Strain. | Anchor. | Strain. |
|---|---|---|---|
| Cwt. | Tons. | Cwt. | Tons. |
| 1 | 3⅜ | 11 | 12⅞ |
| 2 | 4¼ | 12 | 13⅞ |
| 3 | 5¼ | 13 | 14⅜ |
| 4 | 6⅜ | 14 | 15⅝ |
| 5 | 7⅜ | 15 | 16⅛ |
| 6 | 8¼ | 16 | 17¾ |
| 7 | 9¼ | 17 | 18¼ |
| 8 | 10⅛ | 18 | 19 |
| 9 | 11⅛ | 19 | 19⅞ |
| 10 | 12 | 20 | 20⅜ |

TABLE II.—Shows the amount of proof strain applied to chain cables in the dockyards; the weight of the anchors to which they are severally appropriated; and the weight of the cable (with four swivels and eight shackles) per every 100 fathoms.

| Size of Chain Cables. | Proof of Strain in Tons. | Weight of Anchor used with them. | Weight of Cable per 100 fathoms. | | |
|---|---|---|---|---|---|
| Inches. | Tons. | Cwts. | Cwt. | qrs. | lbs. |
| 7/16 | 3½ | 1 to 1½ | 9 | 0 | 21 |
| ½ | 4½ | 1 to 1½ | 12 | 0 | 0 |
| 9/16 | 5½ | 2 to 2½ | 15 | 0 | 20 |
| ⅝ | 7 | 2 to 2½ | 18 | 3 | 0 |
| 11/16 | 8½ | 3 to 4 | 22 | 2 | 21 |
| ¾ | 10⅛ | 5 to 5½ | 27 | 0 | 0 |
| ⅞ | 13¾ | 6 to 8 | 36 | 3 | 0 |
| 1 | 18 | 9 to 11 | 48 | 0 | 0 |
| 1⅛ | 22¾ | 12 to 15 | 60 | 3 | 0 |
| 1¼ | 28½ | 16 to 21 | 75 | 0 | 0 |

TABLE III.—Showing the comparative strength between iron chains and hemp rope.

| Size of the Chains. | Weight per fathom. | Proof Strain. | Size of a Rope. | Weight of Rope per fathom. |
|---|---|---|---|---|
| Inches. | lbs. | Tons. | Inch. | lbs. |
| 5/16 | 6 | ¾ | 2¼ | 1½ |
| ⅜ | 8½ | 1½ | 3¼ | 2¼ |
| 7/16 | 11 | 2¼ | 4 | 3¼ |
| ½ | 14 | 3¼ | 4¾ | 5 |
| 9/16 | 18 | 4¼ | 5½ | 7 |
| ⅝ | 24 | 5¼ | 6¼ | 8½ |
| 11/16 | 28 | 6½ | 7 | 10½ |
| ¾ | 32 | 7¾ | 7½ | 12 |
| 13/16 | 36 | 9¼ | 8¼ | 15 |
| ⅞ | 44 | 10¾ | 9 | 17½ |
| 15/16 | 50 | 12½ | 9½ | 19½ |
| 1 | 56 | 14 | 10 | 22 |

## TABLE IV.—Of chain cables.

| Per Fathom. | Diameter of Iron. | Substitute for a Rope in circumference. | Proof Strain. | Supposed Tonnage. | Weight of rope substituted per fathom. |
|---|---|---|---|---|---|
| lbs. | Inch. | Inch. | Tons. | | |
| 8 | 3/8 | 4 | 2 | | 4·32 |
| 10½ | 7/16 | 4¾ | 3 | | |
| 13½ | ½ | 5¼ | 4 | 20 | |
| 17 | 9/16 | 6 | 5 | 35 | 9·72 |
| 24 | 5/8 | 6½ | 6 | 50 | |
| 27 | 11/16 | 7 | 8 | 70 | 13·23 |
| 30 | ¾ | 7½ | 9¾ | 90 | |
| 36 | 13/16 | 8 | 11¼ | 110 | 17·28 |
| 42 | 7/8 | 9 | 13 | 130 | 21·87 |
| 50 | 15/16 | 9½ | 15 | 150 | |
| 56 | 1 | 10½ | 18 | 170 | |
| 60 | 1 1/16 | 11 | 21½ | 200 | 32·67 |
| 86 | 1¼ | 13¼ | 38½ | 320 | |
| 125 | 1½ | 16 | 43 | 500 | |

## TABLE .V—Of the weights of tarred cordage.

| Weight of Hawsers of 130 fathoms each, | | | | Weight of Hawsers of 120 fathoms each. | | | |
|---|---|---|---|---|---|---|---|
| Inch. | Cwt. | qrs. | lbs. | Inch. | Cwt. | qrs. | lbs. |
| ¾ | 0 | 1 | 4 | 2 | 1 | 1 | 4 |
| 1 | 0 | 1 | 20 | 2½ | 1 | 3 | 0 |
| 1½ | 0 | 3 | 13 | 3 | 2 | 2 | 11 |
| 2 | 1 | 1 | 6 | 3½ | 3 | 1 | 22 |
| 2½ | 2 | 0 | 5 | 4 | 4 | 0 | 18 |
| 3 | 2 | 3 | 20 | 4½ | 5 | 0 | 23 |
| 3½ | 3 | 3 | 7 | 5 | 6 | 2 | 1 |
| 4 | 5 | 0 | 14 | 5½ | 7 | 3 | 7 |
| 4½ | 6 | 1 | 22 | 6 | 9 | 0 | 12 |
| 5 | 7 | 3 | 19 | 6½ | 10 | 1 | 19 |
| 5½ | 9 | 2 | 2 | 7 | 12 | 0 | 18 |
| 6 | 11 | 1 | 13 | 7½ | 13 | 3 | 16 |
| 6½ | 13 | 1 | 11 | 8 | 16 | 0 | 6 |
| | | | | 8½ | 18 | 0 | 26 |
| | | | | 9 | 20 | 1 | 17 |
| | | | | 9½ | 22 | 2 | 9 |

## TABLE VI.—Showing the weight of 100 fathoms of cable laid rope, from two to twelve inches, with the comparative size of chain.

| Size. | Threads. | Weight. | | | Chain equal. |
|---|---|---|---|---|---|
| Inch. | | Cwt. | qrs. | lbs. | |
| 2 | 27 | 0 | 3 | 26 | |
| 2½ | 36 | 1 | 1 | 8 | |
| 3 | 54 | 1 | 3 | 25 | |
| 3½ | 72 | 2 | 2 | 16 | |
| 4 | 99 | 3 | 1 | 6 | 3/8 |

TABLE VI.—(*continued*).

| Size. | Threads. | Weight. | | | Chain equal. |
|---|---|---|---|---|---|
| Inch. | | Cwt. | qrs. | lbs. | |
| 4½ | 108 | 3 | 3 | 24 | |
| 5 | 135 | 4 | 3 | 23 | |
| 5½ | 162 | 5 | 3 | 22 | |
| 6 | 189 | 6 | 3 | 21 | |
| 6½ | 216 | 7 | 3 | 21 | |
| 7 | 252 | 9 | 1 | 1 | |
| 7½ | 288 | 10 | 2 | 9 | |
| 8 | 336 | 12 | 0 | 26 | ¾ |
| 8½ | 378 | 13 | 3 | 15 | |
| 9 | 423 | 15 | 2 | 25 | |
| 9½ | 468 | 17 | 0 | 22 | ⅞ |
| 10 | 522 | 19 | 0 | 21 | 1 |
| 10½ | 576 | 21 | 0 | 19 | 1 |
| 11 | 630 | 23 | 0 | 18 | |
| 11½ | 684 | 25 | 0 | 15 | 1⅛ |
| 12 | 747 | 27 | 1 | 23 | 1⅛ |

MEM.—One-eighth of an inch of iron in diameter is more than equal to an inch of hemp rope in circumference.

Much has been written and said about anchors, and since Mr. Pering first commenced anchor reform some sixty years ago, we have had many and various plans experimented upon, with a view of producing a perfect anchor. Many descriptions of anchors are known at the present time ranging from the simple improvement of Mr. Pering, up to that most ingenious mud-puzzler invented by Mr. Isaacs, of the United States. Of all these different plans, however, three only appear to fulfil the necessary conditions requisite to constitute a genuine good mud hook. These three are Trotman's (formerly known as Porter's Patent), Rodger's, and the Admiralty anchor. The Admiralty commenced a series of experiments in 1839, which were continued in subsequent years, with a view of ascertaining the merits of the different anchors submitted to them at various periods; but notwithstanding the amount of information that was, or ought to have been, collected under this head, it remained for the Great Exhibition year of 1851 to bring before the nautical public the question as to whether any, and what, improvements had been made. On 1st of September, 1851, a grand trial took place at the building in Hyde Park between the rival proprietors of Porter's and Rodger's, the experiments were made under the inspection of W. S. Lindsay, Esq., M.P., the well-known and experienced ship-owner. No satisfactory result, however, was arrived

at beyond the fact that the Admiralty anchor, known as Sir W. Parker's, appeared to be much inferior to the two patented "killicks."

There having been various plans of anchors exhibited, this trial give rise to no little commotion amongst the parties interested; and eventually a memorial was got up by the leading shipowners of London, Liverpool, and Glasgow, requesting that a public trial should take place to test the relative merits of the different anchors shown at the Great Exhibition. Accordingly in July, 1852, a commission consisting, on the part of the shipowners, of Messrs. W. S. Lindsay, Anthony Ridley, Duncan Dunbar, William Drew, George Marshall, and William Phillips; and on the part of the Admiralty, of Captain Stopford, of H.M.S. London, Captain Munday, of H.M.S. Waterloo, Captain Charles Hope, of H.M.S. Monarch, the Master-Attendant, Sheerness Dockyard, the Master of the Flag Ship, and Mr. James Tonkin, Assistant-Master-Attendant, Portsmouth Dockyard, assembled at Sheerness, and to them we are indebted for the following statistical information:—

The anchors tried were: Trotman's, Rodger's Mitcheson's, Lenox's, Honiball's' Aylen's, Admiralty, and Isaacs.' The committee considered these anchors, after being tested, to stand in the following order, the Admiralty anchor being selected as the standard or unit, a value of 18·17 out of 160 being assigned to it upon trial.

| | | | | |
|---|---|---|---|---|
| 1.—Trotman's | 1·28 | ·28 | per cent. superior | to Admiralty |
| 2.—Rodger's | 1·26 | ·26 | " | " |
| 3.—Mitcheson's | 1·20 | ·20 | " | " |
| 4.—Lenox's | 1·13 | ·13 | " | " |
| 5.—Honiball's | 1·09 | ·9 | " | " |
| 6.—Aylen's | 1·09 | ·9 | " | " |
| 7.—Admiralty | 1· | The standard or unit. | | |
| 8.—Isaacs' | ·73 | ·27 | per cent. inferior | to Admiralty |

From this it appears that six of these anchors were superior to the Admiralty. Five of these anchors are considered, by competent authority, objectionable on general grounds, so that we have the trial for relative superiority reduced to three anchors—viz.: Trotman's, Rodger's, and the Admiralty, or, as yachtsmen may denominate it the "Plain Anchor." The properties essential to a good anchor, with their "approximate values," were considered by this committee to be as follows:—

| | |
|---|---|
| 1.—Strength computed from the first crack | 15 |
| 2.—Holding power at long and short scope | 80 |
| 3.—Facility of stowage | 10 |
| 4.—Quick holding | 15 |
| 5.—Quick tripping | 5 |
| 6.—Exemption from fouling | 10 |
| 7.—Facility of sweeping | 5 |
| 8.—Facility of transport in boats | 5 |
| 9.—Fishing in a heavy seaway | 10 |
| 10.—Canting | 5 |
| | 160 |

The trials of these anchors, according to the above table, gave the following results:—

1.—Strength computed from the first crack—value 15.

| | Cwt. | qrs. | lbs. | Cracked at | Value. |
|---|---|---|---|---|---|
| 1.—Trotman's | 21 | 1 | 10 | 51½ tons | 2·22 |
| 2.—Admiralty | 20 | 2 | 0 | 48 " | 2·07 |
| 3.—Rodger's | 19 | 0 | 8 | 45 " | 1·94 |

Difference in favour of Trotman's over Admiralty 15 per cent., and of Admiralty over Rodger's 13 per cent.

2.—Holding powers at long and short scope—value 80.

| | |
|---|---|
| 1.—Trotman's | 14·44 |
| 2.—Rodger's | 10·69 |
| 3.—Admiralty | 6·42 |

3.—Facility of stowing—value 10.

| | |
|---|---|
| 1.—Admiralty | 1·82 |
| 2.—Rodger's | 1·82 |
| 3.—Trotman's | ·91 |

4.—Quick holding—value 15.

| | |
|---|---|
| 1—Rodger's | 2·36 |
| 2.—Admiralty | 2·01 |
| 3.—Trotman's | 1·77 |

5.—Quick tripping—value 5.

| | |
|---|---|
| 1.—Admiralty | ·89 |
| 2.—Rodger's | ·67 |
| 3.—Trotman's | ·31 |

6.—Exemption from fouling—value 10.

| | |
|---|---|
| 1.—Trotman's | 1·85 |
| 2.—Admiralty | ·65 |
| 3.—Rodger's | ·64 |

7.—Facility of sweeping—value 5.

| | |
|---|---|
| 1.—Admiralty | ·95 |
| 2.—Rodger's | ·95 |
| 3.—Trotman's | ·29 |

8.—Facility of transport in boats—value 5.

| | |
|---|---|
| 1.—Rodger's | ·87 |
| 2.—Admiralty | ·65 |
| 3.—Trotman's | ·52 |

9.—Fishing in a heavy sea-way with present fish hook—value 10.

| | |
|---|---|
| 1.—Rodger's | 2·19 |
| 2.—Admiralty | 1·98 |
| 3.—Trotman's | ·55 |

10.—Canting—value 5.

| | |
|---|---|
| 1.—Admiralty | ·73 |
| 2.—Rodger's | ·73 |
| 3.—Trotman's | ·55 |

From these returns it would appear that in three of the most important essentials, Trotman's (or Porter's improved) anchor stands A1—namely, for "strength," "holding powers," and "exemption from fouling."

The Admiralty, or plain anchor, stands first for "facility of stowage," "quick tripping," "facility of sweeping," and "canting."

And Rodger's stands first for "quick holding," "facility of transport in boats," and "fishing in a heavy sea-way."

From the information thus afforded of the respective powers of these anchors, yachtsmen may deduce the following hints:

FIRST.—That for a bower anchor Trotman's is the best.

SECOND.—That for a stream or working anchor, the Admiralty or plain anchor is most suitable.

THIRD.—That for a kedge Rodger's presents the best properties.

In the year 1859 a new style of anchor was introduced to public notice, called Martin's Patent Anchor: the arms are in the solid like Trotman's or Porter's; but instead of like them oscillating in the plane of the shank, they oscillated transversely, so that both flukes enter the ground at the same time. Mr. E. Rettig, Walbrook Buildings, London, is the patentee and proprietor of the anchor, and he claims for it the following important properties:—

FIRST.—That it takes hold instantly, no matter in what position it reaches the ground.

SECOND.—That its holding power is 100 per cent. greater than the ordinary anchor, 75 per cent. over either Porter's or Rodger's, and 50 per cent. over Trotman's.

THIRD.—That, whilst its holding powers so far exceed those of other anchors, it also bears the proportionate increase of strain required.

FOURTH.—That from the nature of its construction this anchor can be tripped and fished much more easily than any other.

FIFTH.—Having no stock, and both flukes being in the ground at the same time, it can neither foul nor become fouled; it can also be catted flat alongside the bow; and being composed of three main parts, can be taken to pieces and stowed away with great facility.

SIXTH.—That being much lighter than any other anchor, it greatly lessens labour.

SEVENTH.—That it is the cheapest of all anchors.

Having inspected this anchor, I feel bound to say that the properties he claims for it do not seem incompatible with its form: it appears to be a powerful, easily-handled anchor—must have great powers of holding, strength combined with compared lightness, and would seem well adapted for yachts.

Mr. Rettig furnishes a table of the relative weights of the ordinary anchor, Trotman's, and Martin's Patent, which I give an extract from up to 300 tons.

Relative weights of different anchors with ships' tonnage:—

| As per Lloyd's List. | | | | Trotman's Anchors, iron stock. | | Martin's Patent. |
|---|---|---|---|---|---|---|
| Ship's Tonnage. | Size of Chain. | Length of Chain. | Ordinary Anchors, iron stock. | | | |
| | Inch. | Fathoms. | Cwt. | Cwt. | qrs. | Cwt. |
| 50 | $\frac{11}{16}$ | 120 | 4 | 3 | 0 | $2\frac{1}{2}$ |
| 75 | $\frac{3}{4}$ | 120 | 5 | 3 | 3 | 3 |
| 100 | $\frac{7}{8}$ | 150 | 7 | 5 | 0 | 4 |
| 150 | 1 | 180 | 10 | 7 | 2 | 6 |
| 200 | 1 | 180 | 12 | 9 | 0 | 7 |
| 250 | $1\frac{1}{8}$ | 200 | 15 | 11 | 2 | 9 |
| 300 | $1\frac{1}{4}$ | 200 | 17 | 13 | 0 | 10 |

By the above table it will be perceived that Martin's anchor possesses the advantage of lightness, combined with the requisite strength, as compared with Trotman's or the ordinary anchor.

On the 15th of August, 1859, a series of experiments were made upon the sands at Gateshead on the Tyne, to test the comparative hold-

ing Powers of Rodger's, Trotman's, and Martin's anchors. These were made in the presence of a number of the Brethren and Members of the Trinity House, Newcastle-on-Tyne; together with a number of ship-owners and masters, who evinced much interest in the trials.

The anchors were tested in the following manner: they were laid on the level sand, and drawn together by a triple block with a chain fall, and two winches fitted with fly-wheels. An anchor of Mr. Rodger's of the weight of 7cwt. 2qrs. 8lbs. was first pitted against one of Mr. Martin's weighing 5cwt. 1qr. 5lbs. The winches having been set in motion, Mr. Martin's anchor at once began to sink, and consequently to grip; by the time Mr. Rodger's had canted, as it must do before it can grip, Mr. Martin's had obtained a firm hold in the ground. The motion of Mr. Martin's anchor gradually decreased as it sunk into the ground, until it almost entirely ceased, Mr. Rodger's anchor, on the other hand, was drawn rapidly towards it until the blocks met. The ground which each anchor had traversed from the starting point was then measured, when it was found that Mr. Martin's anchor had been only drawn 11ft. 8in., whilst Mr. Rodger's had been drawn 54ft. 9in.

The succeeding trial was with the same anchors, and their positions was reversed. In the first trial Mr. Martin's anchor had been placed to the westward, it was now placed to the eastward, and Mr. Rodger's to the westward, so that no advantage might accrue to one over the other by any peculiarity in the nature of the ground; the same test as before was applied, and with similar results, Mr. Martin's anchor coming home only 10ft, 6in., whilst Mr. Rodger's anchor made a drift of 81ft. 1in.; 4cwt. was then added to Mr. Rodger's anchor, making it 11cwt. 2qrs, 8lbs. to Mr. Martin's 5cwt. 1qr. 5lbs., or considerably over double the latter's weight; even under this enormous disadvantage Mr. Martin's was drawn through a less distance by 6in. coming home 10ft. 8in. to Mr. Rodger's 10ft. 9in. 2cwt. were then taken off Mr. Rodger's, when it was drawn home 9ft. 5in., whilst Mr. Martin's only drew 4 inches.

The most important trial was next proceeded with. As may be seen from the experiment at Sheerness, Trotman's anchor proved itself the best known; and one of his was put down against Martin's; the weight of it was 5cwt. 1qr. 11lbs., and a heavier one, it is stated, would have been used were it at hand. At the first trial Mr. Trotman's anchor was

drawn a distance of 61ft. 9in., and Mr. Martin's 7ft. 8in. In the second trial their positions were reversed, as in the case of that with Mr. Rodger; the result was that Mr. Trotman's made a drift of 32ft. 10in., whilst Mr. Martin's drew only 7ft. 9in. At this point Martin's anchor became stationary, whilst Trotman's was still coming home. 2cwt. was next added to Trotmans, making it 7cwt. 1qr. 11lbs.; with this addition it came home 21ft. 8in., whilst Martin's only drew 5ft. 6in., and then became steady.

These, no doubt, were most important trials, and we must look forward anxiously to see how Mr. Martin's anchor performs at sea. Mr. Rettig claims for Martin's anchor that it has no stock; but in those I inspected at Cowes there was a short-curved stock some distance down from where the square would be in an ordinary anchor. With respect to the originality of the invention as claimed by Mr. Martin, I may be permitted to express my doubts, inasmuch as a Mr. R. F. Hawkins invented an anchor some years ago, with the flukes oscillating in a precisely similar manner, and without any stock whatever, and for which the inventor claimed similar advantages over ordinary anchors. Mr. Hawkins's anchor worked with what he called a "toggle" in the throat of the shank, but which might as appropriately have been termed a sector. Mr. Martin's works with a similar application somewhat differently applied—in fact, his sector works somewhat like the upper arm of a Trotman's anchor on the shank, and thus forms a powerful lever. The essential difference, however, is that Martin's anchor can be taken to pieces, and is portable, whilst Hawkin's cannot; so that, in point of fact, Martin's may be called an improved Hawkins's, the same as Trotman improved on Porter's.

It is strange what an antipathy fore-mast Jacks have to Porter's and Trotman's anchors; whether through awkwardness or carelessness, I know not which, but they are invariably jamming their fingers with the oscillating arms, and many a prayer have I heard uttered "wrong end foremost" at the "crab claw mud hooks," as they term them; besides which Jack afloat has his prejudices as well as Hob the ploughman ashore; and not very long since I had a conversation with a very excellent and clever seamen, who, notwithstanding any argument to the contrary, vowed that these new-fangled notions were all humbugs, and that there was nothing half so good for the purposes required as the old-fashioned "hold-me-fast" that our forefathers used before us. There is

no doubt that for yachting purposes no anchor is so convenient or handy as Trotman's, from the facility with which it can be taken to pieces and stowed below when not required; and I see no reason if Rettig's turns out well in actual working, why it may not become as much a yachtsman's anchor.

I have written thus mutch upon the subject of anchors and chains, as I consider them one of the most important departments of a yacht's fit-out; and, when cruising, nothing gives more confidence if lying in a strange anchorage, or that a yachtsman gets caught down some deep bay with the wind dead on shore and no room to get underway, than the reflection that his ground tackle will hold the ship as long as there is a plank of her together.

I need hardly say that both anchors and chains should be galvanised, and it is well to examine both before they are galvanized, and also to have them proved afterwards, for it must be remembered always that the galvanizing process weakens iron 25 per cent. Now, galvanizing acts the part to the bad or careless smith, that clay does to the ditto doctor —it hides bad work; so that if there be indifferent welding in a link, or a faulty scarf in crown or shank, when galvanized, all will look like a deceitful apple—fair to the eye, but rotten at the core, and a deuced bad time to find this out is when you are in dangerous proximity to a wall of cliffs, a ridge of rocks, or a foam-covered sand-bank. Therefore, before anchor or cable come on board, they should be thoroughly tested and proved, and in the tables I have furnished at the commencement of the chapter, I think ample data will be found to go upon.

## CHAPTER XXIV.

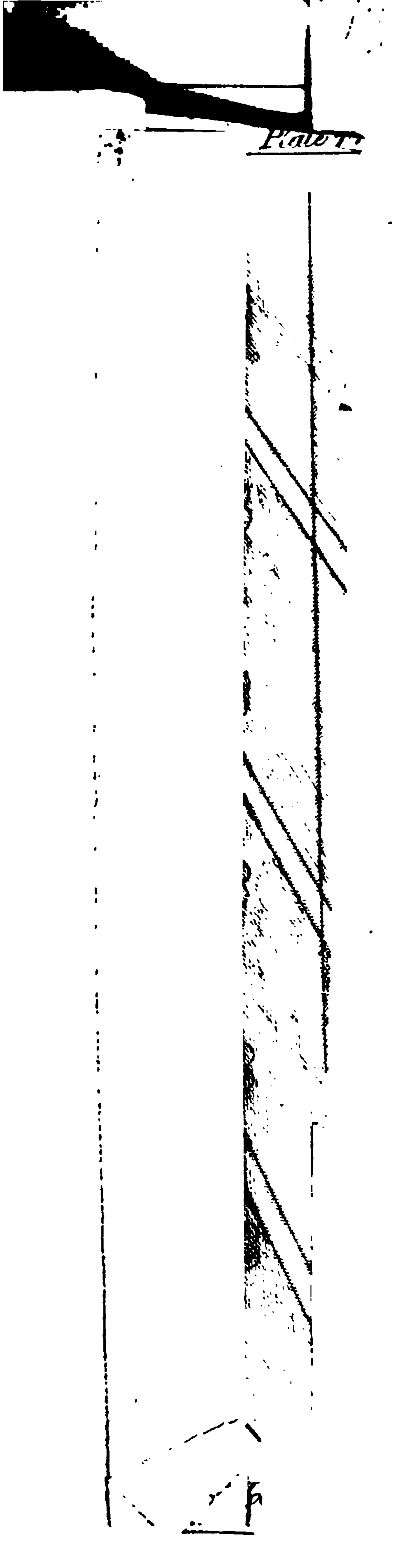
"The sun rose red and fiery, a sure sign
Of the continuance of the gale; to run
Before the sea until it should grow fine
Was all that for the present could be made."—BYRON.

THROUGH the kindness of one of the yachtsmen of the Clyde, Frank Powell, Esq., late of the St. Kilda cutter, I am enabled to lay before my readers a sketch and description of a new plan of iron gaff jaws, which appears to be possessed of many advantages. The Chance schooner, 72 tons, the St. Kilda, cutter, 20 tons, and the Anita schooner, 60 tons, have their gaffs fitted with these jaws, and they have been found to answer well. Mr. Powell states "that they are far preferable, and look much neater than any other; they never jam or catch, neither do they chafe or press the mast as ordinary jaws do, and when running before the wind or jibing there is no danger of their springing away from the mast."

The following key will explain the sketch:—A, the mast: B, the gaff; C, throat of mainsail; D, throat halliard lower block; E, topsail sheet fall leading block, attached by clip or sister hooks to the eyes of the bolt H, and which bolt fastens the gaff at G to the jaws F. I, the neck bolt fastening the throat of the mainsail to the gaff: J, the spurs of the iron gaff end, which are slightly rivetted to the spar, but owe their chief strength and solidity of position to the hoop K; L, bead blocks for the parral fastening the jaws to the mast; N the neck of the jaws by which they are constantly kept in a horizontal position, however much the gaff may be peaked or dropped, also to allow the lower throat block to clear the mast.

Plate 47, Fig. 1 represents the gaff and jaws combined. Fig. 2 shows them as taken asunder. Fig. 3 shows where the nock of the mainsail is fastened. Fig. 4 shows the under part of the gaff. This appears to be a very excellent plan, and I think an improvement upon it would be, if the neck N of the jaws were continued beneath them as in the dotted line of Fig. 2, at O, it would then keep the jaws more steady, and take the strain or weight of the gaff off N, throwing it entirely on the mast.

*Plate I*



However, this is merely a suggestion arising from an inspection of the sketch, as I have never seen these gaff fittings in actual work. One very great advantage is obviously, particularly to a racing cutter, and that is the facility with which a gaff could be replaced if carried away, for by carrying a spare gaff all ready fitted, and if thought necessary spare jaws also, should either give way, a smart crew would in a few minutes make good the damage.

Another very simple but efficacious plan for making the hoops of the mainsail play fairly and freely upon the mast has been suggested by Harry Bridson, Esq., of the Derwent schooner. We have all seen frequently how the hoops will jam when the sail is being hoisted, and very often how one of the hands will have to jump upon the boom and fleet them up the mast. In Fig. 5, I have endeavoured to explain Mr. Bridson's suggestion, by which to prevent the occurrence of this difficulty:—A, the mast; B, mast hoops attached to the mainsail; C, a light line seized to the mast hoops so as always to keep them in a horizontal position. If every yachtsman would but follow the example of Mr. Powell relative to the gaff, and Mr. Bridson in connection with the mast hoops, a very great fund of valuable information would be collected. We are all more or less possessed of some practical knowledge upon points relative to yachts' rigging, spars, sails, and hulls; individually these items of knowledge may appear very insignificant, but if through the kind co-operation of those interested in the subject of Yachts and Yachting, they could be embodied in these or similar papers, diffuse matter which at present is confined to individuals, would be found of general advantage to all.

I now come to the subject of ballast. Writing upon this I must divide it under three heads—firstly, the materials of which ballast is composed; secondly, the manner in which it should be stowed; and, thirdly, its effect upon a vessel.

The materials in general use for ballasting yachts are iron and lead; I have also seen sand, shingle, sulphur ore, copper dross, and blocks of stone used; but these latter will never be found on board a thoroughly well found yacht, they are used only when iron or lead is difficult to be obtained, and through inability to procure either, or from motives of economy; sometimes a ground tier of iron ballast will be laid down, and then shingle or sulphur ore over that; and I have known instances, I am happy to say but few, where purchasers of yachts have found them

selves woefully deceived by a superficial appearance of metal, and the ground tier all sand and stones; so that as a rule when purchasing a yacht the platforms fore and aft should be taken up, and the materials composing the ballast strictly investigated, for, as I will show presently, all sorts have their marketable value, and the ballast of a yacht somewhat adds to or depreciates her value. Independent of this consideration, whatever material we can find heaviest in specific gravity, is the best for yacht's ballast, as admitting of being stowed lower, and thus making her stiffer under canvas, and as occupying less space than lighter and consequently more bulky ballast, and therefore enabling increased head room and better accommodation to be obtained.

Iron and lead are used in two ways as ballast, either plain and in the rough as they come from the merchants, or cast according to moulds so as accurately to conform to the internal shape of the vessel's bottom. With the exception of gold, mercury, and platinum, lead is the heaviest metal known; the specific gravity of lead, water being the standard of comparison, or 1·000, is 11·352. Instances occur, but rarely of yachts being entirely ballasted with lead, but as lead ranges from £18 to £23 per ton, and sometimes much higher according to the state of the market, the expense is rather too formidable to admit of its general adoption in more than small quantities. Bar iron has a specific gravity of 7·700, and is ·536 in numbers of specific gravity heavier than cast iron. Vessels laden with bar iron have given evidence of much higher speed than when laden with any other cargo, and it is considered that bar iron constitutes the liveliest ballast that can be put into a vessel; but then there is a difficulty in the stowage of bar iron, which, added to its expense, has not facilitated its adoption to any extent as yacht's ballast. Cast iron as a specific gravity of 7·264, and from its general adaptability is in more general use than any other metal for this purpose.

In its first form the metal is allowed to flow from the furnace into rudely shaped channels on the ground, and when cooled is taken up in the form of rough bars, about three feet long, and weighing nearly one cwt. each; these are what is technically called "pigs," It is usual to make moulds of wood to fit easily between the flooring timbers of a vessel, and then to re-cast these pigs so that the blocks of metal will fit down between the timbers, and form a ground tier of what is known as cast limber ballast, the rough pigs may then be stowed over this, and thus the full complement of ballast made up of pig and cast metal; some-

times instead of pig metal being used for filling up, what is called scrap iron—*i.e.*, broken pieces of wrought and cast iron, old furnace bars, &c., come into use.

The following are the current prices of iron ballast—cast metal limber pieces about £6 per ton. In well found vessels all the filling up ballast will also be cast into square blocks, having a diagonal hole at each end, through which a grummet or rope, or an iron ballast hook may be inserted in order to facilitate their removal and stowage; these will be about from half to one-and-a-half cwt. each, just what either one or a couple of men can handle easily. I have seen these blocks cast in triangular pieces, each pair to form a square block, and they stowed remarkably well, particularly along the sides of the vessel. These may be estimated at the same price as the limber pieces—viz., £6 per ton; pig iron about £3 10s. to £4 per ton; and scrap iron may be had from £1 to £2 10s. per ton; if of a superior quality, it may run to £3 10s. per ton. Boiler punchings (the little round discs of iron that are punched out of boiler plates when making the holes for rivets), also make good filling ballast, if they are filled into tarred hemp bags, holding about half a cwt. each, made of strong sacking; but the smell from these bags may prove rather overpowering to delicate nerves: and therefore, under such circumstances perhaps tarring might be dispensed with. These punchings being of wrought iron weigh heavily; they may be had for from £3 10s. to £4 per ton. [These prices are now of course much higher.—Ed.]

I will now specify what may be considered the best method of ballasting a well-finished and A1 yacht, and mention afterwards such alterations of material as would tend to economy in expense. It is now an established practice to stow the ballast as much in the body of a vessel as possible, for reasons which I will refer to more particularly hereafter; there is thus left a considerable space forward and aft beneath the forecastle and after saloon floorings, in which much dirt, cinders, shavings, and various odds and ends that tend to engender pestilential odours and rot accumulates. In order to prevent this it is an excellent plan, and one now much followed, to fill up these empty spaces with a cement composed of Parker's Roman Cement or Portland Cement, two-thirds, and Drift Sand one-third; the openings should previously be well payed with coal tar; sometimes pebbles or boiler punchings are mixed with this cement, but I do not think an extra ounce weight ought to be added

to the cement either forward or aft of the main body of ballast; then the lower tier of the main ballast should be all cast blocks of metal to fit well down between the floorings. These blocks may be fitted in with and bedded down upon cement, and in this boiler punchings may be mixed, and all the interstices filled in, so that as much weight as possible may be got low down in the vessel's body; there will then be a nice clean platform of cement and ballast right fore and aft the vessel, which can be kept clean with but little trouble; and the little bays of putrid water and filth that otherwise accumulates will be securely guarded against. If this lower tier of castings be of lead, or a portion of them, so much the better, the lower the principal weight is the stiffer the vessel will be under canvas. If, however, the lead is not cast, and that it is proposed to have a portion in pigs, they should be stowed on the top of the castings, and the requisite quantity of ballast then made up of the cast blocks. It is advisable, however, when it can be done, to have the lead cast to mould, and to get it as low in the vessel as possible so as to derive the greatest amount of benefit from its use. If the vessel is of light draught of water, and that consequently head room in her main saloon is an object, some ballast may be cast into blocks the shape of the vessel's side, which can be stowed between her timbers, or, as it is termed, winged up her sides as high as the cabin sofas; the lockers of the sofas also may be constructed to contain blocks of ballast, and I have seen a good deal of additional head room obtained by having the main saloon floored with heavy plates of lead or cast iron instead of with pine or deal. If wing ballast be cast to fit between the timbers, every block should have a little strap or shoulder at each corner, upon which they should rest upon every timber, so as not to touch the skin or planking, for not an ounce of ballast should be allowed to rest upon the planking, it should all be borne by the framework of the vessel; by these shoulders the blocks can be spiked or screwed to the timbers so as to keep them from shaking loose when a vessel is careened over.

This wing ballast may be used with advantage in a large vessel as well as a small one, but with a different object; the object of winging ballast in a small vessel will be to get head room, but in a large vessel where there is enough and to spare, winging the ballast may be found to counteract severe rolling in a cross sea; for although it is most desirable to have the ballast stowed as low as possible in order to make the vessel stiff, and thereby to hold a good wind, yet there is a drawback to it in

the fact that the greatly increased leverage thereby obtained causes a vessel to roll and labour much with a beam sea, particularly if there should be but little wind; a favourable compromise may be effected in such case by winging a portion of the ballast as above described. I think, however, a good deal of this rolling, ordinarily attributed to the fact of the ballast being stowed low, may with more justice be ascribed to the form of the midship section of the vessel, and that a vessel owing her stability under canvas entirely to her ballast, which will generally result from a weak form of midship section, will roll more than a vessel possessed of a proper amount of stability from the nature of her construction. I have been induced to draw this conclusion from the close observation of the performances of some vessels of this class.

In addition to the limber piece castings of lead or iron, there should be a heavy oblong block of metal cast for the mast to step in (for schooners there should be two blocks), this block should have a long groove in it to receive the tongue of the heel of the mast, and this groove should be of sufficient length to admit, should occasion arise, of the heel of the mast being shifted forward or aft, wedges being used to retain the heel firmly in the position assigned to it; this stepping-block should be bolted to the keelson fore and aft. Many opinions have been expressed as to the benefits to be derived from the use of a metal keel; from personal observation, and the majority of opinions I have gathered upon this subject, I should certainly say that in a vessel possessed of good natural stability, a metal keel is of most essential service; by it a considerable portion of ballast can be placed where its effect will be exercised to the greatest possible advantage. And although I am aware that a metal keel is objected to by some as causing the rolling I have before alluded to, I believe that such vessels would roll from the nature of their construction just as much without a metal keel as with one; its general advantages very much preponderate over the few particular objections to its use, and upon the whole, I would say, by all means supply to your yacht, as an important item of her ballast, a metal keel. Lead is much to be preferred to iron for a keel, not only from its weight, and that you can get pound for pound more of it into a certain space than iron, but because there is no corrosive action of any important extent taking place between it and the copper sheathing; the expense of it is the only drawback; but as before remarked, a lead and iron keel will be found the best lesser weight in iron and at the bottom. I would far

prefer, were a certain portion of lead determined to be used in ballasting a yacht, having as much of it as possible applied as a keel, than stowing it internally. If a lead keel be used it should be fastened on with screw bolts and nuts, and the heads of these bolts should be countersunk into the lead for two or three inches and then plugged over with wood, so as to preclude the possibility of the bolts being corroded by the action of the copper.

I have seen an iron keel left upon the ground after a yacht, that was having her copper cleaned, had been floated off, owing to the bolts that fastened it to the keel having been eaten away by the corrosive action of the copper sheathing. Getting rid of two or three tons of ballast in this way at sea without knowing anything of it, would be rather a serious business. If an iron keel is applied, care should be taken that the copper sheathing should not come within an inch or two of the iron; should the iron and copper come in contact the action will be rapid, but thus leaving a space of wood between them, the effects of the copper upon the iron is comparatively weakened. In having the filling up pieces of ballast cast, it is a great advantage to have them of small handy blocks, not exceeding in weight from 56lbs. to 84lbs., I should prefer 56lbs. as they will then be exceedingly handy, and should any circumstances occur requiring the ballast to be quickly removed and got overboard, men can work them with extreme rapidity. The limber pieces will be much heavier and larger, owing to their shape, and the purposes they are destined for; each piece should have a couple of stout countersunk ringbolts cast into them at the ends of their upper sides, in order to facilitate their being lowered into their berths, or removed therefrom.

In making the wooden moulds to have these limber pieces cast from, it is advisable that they should be made to fit loosely into their positions in order to allow for the swelling of the metal in the sand moulds, as if not, the iron castings may be too large, and then some portion of the timbers and keelson must be cut away to make them fit. The method of casting, too, has considerable effect upon the weight of ballast; some castings are so rough and full of sand and air bubbles, that they are more like honeycomb than anything else, these will generally be found light and not half so effective as clean work. Well and properly cast ballast will turn out sharp and clean as chiselled marble, and will be worth considerably more than the other. I have seen castings that

had been "packed," that is, an iron rod was inserted in the top of the mould, and while the molten metal was being poured in, this rod was kept moving up and down gently, like a piston; these turned out beautifully.

It will be found a great addition to the cleanliness and sweetness of a vessel to have this ballast painted, but unless it is done immediately that the castings are taken out of the sand it will not have half the effect. The best paint that I have seen used for this purpose is red lead mixed with linseed oil, and then boiled until it burns a feather, when cool, patent dryers may be added to ensure its hardening quickly. When a yacht is laid up for the winter, or at any suitable period, all this ballast should be taken out, with the exception, of course, of that which is cemented down, and the bottom internally get a thorough cleansing and white-washing, and the ballast also, not only will this sweeten her, but as she floats light she will dry out and not become so thoroughly water-soaked and soddened; her form will be better preserved, and her buoyancy much improved. In fact, if a yacht could be hauled up high and dry for a short period each season, so as to let her timbers and planking dry out, it would be better still, but then some judgment must be exercised in doing so, for were she allowed to remain longer than necessary her planking might shrink and thus involve the wrinkling of the copper, and the necessity of having her stripped and re-caulked.

In stowing the limber ballast it is well to exercise care in having every crevice and nook filled in with the cement before mentioned; if not the limbers must be kept clear, so as to lead any leakage down into the pump well; it is a good plan to have a small galvanized chain rove through the limber holes so that by drawing it backwards or forwards it may clear away any obstruction to the leakage water running aft into the pump well. The pipes of the pumps are usually perforated with a number of small holes at the end, so as to prevent shavings, cotton waste, oakum, or any other matter getting into and choking the pumps, and it is likewise a useful precaution to have the well itself fenced round with perforated zinc.

The above arrangement of ballast materials may be considered the best that can be adopted, but it is also the most expensive. Lead may be averaged at about £20 per ton, and the iron castings at £6 per ton; but the yachtsman must remember that lead will nearly always fetch its own price in the market, and that if he is parting with his vessel the

amount of lead ballast may be quoted at the market price of the day, or taken out of her and sold separately; for this reason it is also useful to keep the market-note of the weight of lead that has been put into her; it will satisfy any intending purchaser of what he is about to pay for, and leave nothing to guesswork. Iron ballast corrodes with rest, copper oxydizes, both waste away imperceptibly and decrease in value, but the only loss upon lead will be the interest of the money paid for it during the time it is doing duty for ballast.

If a yachtsman is merely fitting out his vessel for cruising, and that her size does not demand the closest stowage in order to obtain head room, he may economise the expense of ballast in several ways as follows:—By dispensing with lead and having an iron keel and cast iron limber pieces, he may use pig iron for filling up ballast above the castings; thus his cost will be £6 per ton for castings and £3 10s. to £4 for the pig iron fillings. Or, if instead of pig he uses scrap iron fillings this will reduce it to from £1 to £2 10s. He may go lower still however, in the scale of expense, and by putting in a lower tier of pig iron only, and filling up with scrap, reduce the cost to £3 10s., and £1 to £2 10s., and if he chooses not to put in a full complement of the latter he may use the heavy mineral substance known as Sulphate of Barytes, or as it is called in mineralogy Heavy Spar, and known in some localities under the denomination of Sulphur Ore: this has a specific gravity of 4·7, and when used for ballast is crushed into small pieces and put into canvas bags holding just as much as can be conveniently handled by one man, it stows remarkably well, and makes excellent ballast; it is advisable to have it encased in double bags, for should it burst the single canvas and get loose down in the vessel's run, it will choke up the limber ways and give no end of trouble to get rid of it. Next to the sulphate of barytes comes copper dross, but although it weighs heavy it does not stow by any means well, consisting generally of large and angular lumps—sometimes round and other times square—so that it is difficult to make it fit any way; it is a good ballast if there be plenty of room to stow it. Sand or shingle ballast should be sewn up in canvas bags also, and if nothing better can be had, will make up very respectable filling ballast; care should be taken lest it, like the sulphate of barytes, gets adrift, as it will give equal trouble to clear the limbers. A cubic foot of gravel weighs about 120lbs.

There is one point with regard to a metal keel which had well-nigh

escaped me, it is, however, I think, of sufficient importance to merit a separate paragraph. I have been much surprised to see some yacht builders run a metal keel from well forward of the midship section right aft to the stern-post, and yet these men would cry out most strongly if an ounce of ballast was found forward or aft in the body of a vessel; why should a vessel be better able to carry a weight on her keel externally than in her run internally? It strikes me that if a weight aft in her body will have an injurious effect upon her speed, that when applied to her keel it will be doubly so. I asked the question recently of an eminent yacht builder, but I could not obtain any satisfactory solution of the mystery; on the contrary, he stated that he did not think it would be the slightest harm if a metal keel ran right fore and aft. I was inclined at first to think that perhaps there was much more in it than my phylosophy dreamed of, but when we came to discuss other points, I found he held some few other opinions that were quite new to me, and about as difficult to understand as the celebrated gaff-yard rig, and which led me to doubt whether he could be equally correct upon the point of metal keels. If we are correct in stowing the ballast amidships as much as possible so as to concentrate the weight, and that experience has proved this system to be correct both in theory and practice, so should we also concentrate the weight of a metal keel within the same limits. In my next chapter I shall have a few observations to make upon the stowage of ballast, in which I shall go into this subject a little more in detail.

## CHAPTER XXV.

"But master Lambton muttered,
And under his breath said he,
'This ship is so crank and walty,
I fear our grave she will be.'"—LONGFELLOW.

HAVING given a general description of the different materials used in ballasting a yacht, I shall now proceed with a few observations upon the methods that have been pursued in stowing this ballast. As I have in the previous chapter observed, lead and metal cast to fit the internal form of a yacht constitute the best materials, and in the stowage of these materials very few words will suffice; but when we come to unite rough pigs of metal, barytes, copper dross, or shingle, some further precautions are necessary. It is of importance that the ballast shall be got low down in a vessel in order to impart to her stability under canvas, it is of equal consequence that it be stowed compacity in her greatest width, or into the body of her, so that she may be lively in a seaway; with cast lead or iron ballast there can be but little difficulty in doing this, and at the same time preserving the requisite amount of head room in the cabins, for cast metal will, it is hardly necessary to say, stow in a much smaller space than loose ballast.

Now about this term "life," as applied to the stowing of ballast; if a bar of iron, let us say two inches square, and six feet in length, be accurately balanced upon its centre, and allowed to oscillate, it will do so with a slow continuous motion, and will continue its oscillations some considerable time, owing to the equable distribution of a weight throughout its entire length; let a current of air be directed against either end vertically, or let the experiment be performed with the bar suspended in water, and the water agitated, still although the motion of the bar may be accelerated or decreased, it will still keep on its sluggish oscillations bursting down or up through the opposing air or water until the power that set it in motion shall have been expended; next take a bar of wood of similar proportions, weigh it against the iron, and let the surplus weight of the iron be placed in the centre of the bar,

balance it similarly to the bar of iron, and upon its being set in motion, its oscillations will be found to be much livelier, and it will sooner return to a state of rest; let the air or water test be applied to it whilst in motion, and it will be found to yield to either, and assimilate its motions to the influence of the force opposed to it.

So it is with a yacht in the distribution of her ballsst, if the latter be spread right fore and aft from end to end, she will be assimilated to the balanced bar of iron, she will be balanced at her greatest beam in the water, and when set in motion by a wave passing underneath her, will oscillate upon the water in a similar manner, plunging by the head heavily into the opposing seas, and scending by the stern in a like manner; she will have no life to rise to the approaching billow, but will wallow heavily and sluggishly into it, burying her bows and bulwarks, and offering a much larger surface of resistance to the passage of the water in so doing; for the leverage being so greatly extended from the centre, will cause her to labour so much the more heavily; likewise when the supporting wave passes from under her bow, she will drop or plunge heavily into the hollow between two waves, being so much leaner forward, and consequently not having the floating power to lift this weight at the end, she will go into and through the next sea instead of over it, and instead of sailing upon the lines from which she was constructed, will present quite an exaggerated form to that intended by the designer.

A vessel thus ballasted, will be termed a sluggish wet vessel, and no matter what is her shape, must be a slow one, for her buoyancy amidships will be overcome by the weight in her ends, tending to drive her into the water instead of over it, and pinning her down when overwhelmed by a weighty sea; such a ballasted vessel, therefore, will have no life in her, for the term life, as applied to a vessel, is neither more nor less than the arrangement of the weights on board in such a manner as to enable her quickly to be poised and balanced, and as it were to assimilate her motions that they may harmonize with those of the waters upon which she floats. She must not combat with the water, and like a blustering bully in a crowd endeavour to fight or tear a passage through it, but gently, and with equal motion, overcome the resistance offered to her progress, lifting her head to the lofty seas quickly and buoyantly, and subsiding gently when the obstruction is overcome.

A vessel which has her ballast concentrated amidships, will be like

the weighted bar of wood, she will not oscillate of herself longer than the passage of the waves that move her, all the weight being placed where her greatest bearings, and the power of her body enables her to support it, leaves the lean bow, and run light and floaty, more as air cases, sharp and wedge-like, to open a passage for the greater body, and at the same time to lift it gently on to the sea, and after the water has passed her body, to deliver it quickly aft, and by the buoyancy of the run to keep her from scending or squatting in the foam. A vessel thus ballasted will be found lively and buoyant, she will not plunge her bow or depress her stern prejudicially to speed in passing through the sea; but will present the least surface of immersion, and sail upon the lines she was designed to; she will conform more readily in her motions to the nature of the path over which she travels, and will sail as a fast ship should, bounding as it were from sea to sea, going over and on the top of the waves, instead of driving heavily with her bow under, and rifting the water into ridges of foam.

The great secret, therefore, in carrying out successfully, and doing justice to the design of the naval architect who has built her, is, to have a vessel properly ballasted; for no matter how handsome she may be, no matter what beauty of form, or excellence of workmanship may render her, as sailors say, "just the thing salt water likes!" if her ballast be not properly adjusted, so as to allow her to remain mistress of her powers of buoyancy, it becomes but a dead sluggish weight in her—an overdone cargo—sufficient for all the purposes of enabling her to stand up to her canvas, but otherwise rendering her wet, slow, uncomfortable, and dangerous; it is the secret, or rather not the secret, but the precaution of stowing the ballast in a concentrated form, that constitutes what is called "giving life" to a vessel; it is her vital power, which, like that of the human frame, if not kept within proper bounds, wears out and destroys the fair form in which it is encased: it is the power by which she is enabled to carry her canvas wings, but it must not be allowed to destroy the body that supports them; by their aid she moves, but the beauties and excellencies of her form must not be sacrificed and rendered useless by the indiscreet application of the power that enables them to be spread; like all other details in yachting, the ballast stowage must harmonize with the form of the ship; for the sea is so fastidious with its favourite flowers that, unless every part harmonizes, the accomplishment of a perfect whole is impossible. In general, the main saloon

or state cabin of a yacht is in her centre, and where the extension of her greatest body affords the most room; in large vessels there may be two cabins in this space, but whether there be two or one, the place for the stowage of the ballast is under the platform of this cabin; not a pound weight should be allowed further forward or further aft, if it is desired that a vessel should perform to the greatest possible advantage. All practical experience that I have been enabled to avail myself of, either from gathering the opinions of those well qualified to entitle them to value, or from personal observation, goes to establish this as a principle. Not long since, I had a conversation with one who is considered to be, if not the first, one of the very best yacht sailors of the age upon this very subject, and his words were: "If you could build your ballast in a solid wall across her midship section, it would be so much the better." But as we cannot do this exactly, we must do the nearest thing to it, and therefore no matter of what material the ballast be composed, let it be stowed as much amidships as possible.

Let any yachtsman whose cruising spirit may lead him to the western coast of Ireland, pause before he passes the Islands of Arran; it will repay him to take a run up Galway bay, he will enjoy beautiful scenery, and should he be anything of an Archaiologist—the quaintest old Spanish town that ever grew from the produce of wine butts or salted fish—but let his object be the quay that abuts upon the minor city where the aboriginal race of the Claddagh flourishes so noisily, there he will see the far-famed Claddagh fishing hookers, little boats that will turn to windward and work in a heavy sea, to the manner built, if not born; work and go too when vessels that could carry two or three of them will make but indifferent weather of it; let him examine the way in which the stones are built in amidships of these little vessels to ballast them for the dangerous seas and wild winds of winter; how closely these stones are confined to a narrow limit on either side of the midship sections; how solidly they are put together, and covered with a platform of flags; upon which too he may often see a brilliant turf fire blazing, with an iron pot suspended over it; let him not despise that iron pot either, for while he is inspecting the wonderful stowage of that primitime ballast, a whole boiling of sweet new potatoes may be going forward, and a few of these, with a fresh herring or two, cooked perhaps by the royal hands of his Majesty—the veritable King of the Claddagh—will refresh the inner man, and enable him to pursue his investigations into the pecu-

liarities of as extraordinary a fleet of boats, unequalled of their class for speed and seaworthiness, that perhaps ever it was his lot to behold. He will get a lesson in ballasting from these little boats worth going all the distance to learn, to say nothing of the insight into the proper method of cooking and eating that primitive Irish dish—"New pitaytees and herrins'!" Let him beware, moreover, of the brilliant eyes and winning smiles of the daughters of the Claddagh, for the sons thereof are prone to jealousy, and can propel a stone from a sling with as fatal accuracy as any rifleman at Wimbledon would send a leaden bullet plumb centre at 500 yards.

*Revenons a nos Moutons.*—Ballast properly stowed, as I have endeavoured to describe, will give that life which is so much talked about, and so much to be desired in a yacht. With cast metal it can be easily accomplished, but with loose pigs of metal, barytes, copper dross, or shingle, a little management may be requisite, particularly in small vessels, where it is desirable upon a light draught of water and low tonnage to obtain as much head room 'tween decks as possible; loose metal pigs, or any other inferior material, occupies so much more room, that it becomes requisite to convert the sofas into ballast lockers, and the cabin table may be made to do duty in a like manner, by having it made in the form of a stout square box without a bottom, and fastened with strong iron angle plates to the floor carlings; in the sofa lockers the ballast may be winged up to the level of the seats, but both these lockers and the table box should be very strongly fitted and clamped with stout iron clamps, for I need hardly say, should any of these lockers or the table give way, and the ballast either contained, fetch away to leeward when the vessel was careened to a strong breeze, the most disastrous results might ensue, perhaps the capsizing of the ship. By this arrangement, very great additional head room may be obtained, without sacrificing much of the stability requisite to be preserved.

I have before alluded to the adoption of cast iron plates for floorings to the cabin instead of plank; a very considerable increase of weight may be gained in this way, and also a couple of inches of head room, as the floor carlings or cross beams of pine upon which a wooden flooring is laid, may be dispensed with altogether, and the plates bedded upon the rough pig ballast. I must say, however, that these metal floorings to cabins are extremely cold and uncomfortable, for no matter what material they are covered with, a chilly cheerless feeling pervades the room,

so that for a cruising vessel they are not at all advisable, but for a small yacht, where a party may go out for merely a few hours occasionally, for fishing or a short sail, they will be found to answer excellently. With a "coach-house" or a "booby-hatch" upon the deck, any amount of head room may be obtained without winging the ballast in lockers: but it is well to bear in mind, that apart from the great disfigurement of the deck, all such superstructures interfere materially with stability, every pound of weight applied in deck fittings is so much top hamper, and counteracts the effects of ballast, for which reason all skylights, coamings, companions, windlasses, and in fact all deck fittings, should be made as low and light as is possibly consistent with the strength requisite to be given them.

In connection with the subject of keeping the eyes and run of a yacht clear of ballast below, neither should any weight that can possibly be avoided, be allowed at the ends of a vessel on deck: if the sharp bow and run are not capable of supporting ballast with advantage inside, how much less will they be able to support heavy weights upon the deck; for this reason I think the general position of the windlass in yachts is very erroneous; it should always be placed as near the mast as possible; and nothing forward save the bitts for securing the heels of the bowsprit. For a like reason heavy taffrail lockers aft should be avoided; and nothing can be more absurd than to see a small yacht showing a battery of brass guns through her bulwarks; the sooner they are run into ballast moulds the better, for a good maroon, or a couple of blunderbusses fitting with a swivel spur into the quarter timber heads, will make quite as much row as one of these ornamental popguns, and prove much more serviceable for the actual requirements of signalling. It is all very well for a good sized schooner to affect the Armstrong "faculty," and even here, when the owner wants to take speed and weather work out of her, he will speedily lower them into the main cabin.

There is another description of life to be imparted to a yacht's movements in the stowage of ballast, which may be termed "Artificial Life;" this is only to be obtained by stowing the ballast on some material of an elastic nature, so that the mass of metal may become a live and not a dead weight in her. I have little doubt upon my mind that this is good and sound in theory, but I never yet saw it carried out in practice. Broom tops I have heard of and seen used, but 40 or 50 tons of iron

soon took the elasticity out of them, and the debris that was shown to me as originally intended to make a mass, composed of lead, cast, and pig metal, spring and jump like blocks of India rubber, appeared like unto nothing else than a pile of minute dust highly coloured with iron rust, and with about as much spring in it as there would be on the face of an anvil. Cork shavings, cork cuttings, and corks themselves I have seen used in ballast, and even slips of cork cut into long lengths placed between pigs, to impart this artificial life, but the shavings came out like triturated fungus, the corks assumed the appearance of attenuated treenails, and the slips with some little American ingenuity might have been converted into scythe blades; the cork "medium," moreover is rather an expensive experiment, and so far as my experience goes, occupies a space that might with much more advantage be filled with iron.

India rubber blocks to be interspersed with the metal pigs I have heard talked of, but never seen used; and apart from the enormous expense, I should think that such a method of making bricks would hardly be productive of the desired results; in fact I do not think there is any material at present known, which will, in a raw state, retain its elasticity under the pressure of tons of iron, much less to think of imparting an elasticity to the iron; to obtain such a result, iron must be set against iron, and such an experiment remains yet to be tried. Captain Hans Busk suggested to a friend of mine the possibility of obtaining the desired elasticity of ballast by constructing a cradle of wrought iron bars upon which the filling pigs might be stowed; this is a suggestion worthy of consideration, although I am inclined to think it would be rather difficult to obtain spring sufficient in the iron bars, from the size that it would be requisite to use in the construction of such a cradle, in order to support, say 10 tons of metal; if such a weight could be got in the centre of the ballast, moving lightly and easily on springs, I think it might be found of great benefit: I have thought that strong hoop iron woven under and over the blocks and metal alternately, like basket work, would give a spring to the mass, but it strikes me that the most effectual method of securing this desideratum would be as follows:—I would have the lower tier of lead or iron ballast cast into limber pieces, and the mast blocks bedded with them down along the keel, with the cement I have mentioned in the previous chapter; it might be then advisable to lay another tier of square filling blocks over them, in order

to get a good sized platform. Upon this platform I would lay down a number of strong spiral springs of about three or four inches in height, rivetted top and bottom to stout iron plates; these springs might be rivetted in lengths of plates to stow either fore and aft or thwartships, on the platform of metal blocks; thus I would construct a strong spring platform or bed, not more than from four to five inches in height, and upon this bed I would stow the filling blocks of ballast. The results of such a plan I should have little fear of; if there is any real benefit to be obtained by an artificial spring in the ballast, or at least a portion of it, and I am strongly of opinion that if effectually secured there is, this appears to me the most practical, and sure method of obtaining it; it could not be out of the way expensive, would occupy but little space, and would be weight where it was wanted at the same time. Perhaps it would tend to the complete success of such an experiment, if the side filling ballast was kept in its place by wrought iron plates, and a square frame of wrought iron plates, like the sides and ends of a box, made to fit over the spring platform in the centre, and calculated to hold about 6, 8, or 10 tons of filling blocks.

A vessel should be ballasted down to the Load Water Line of her construction draught, which can be marked on her stem and stern posts previously to her being launched; it is from this line of flotation that her architect has calculated and designed the lower water lines, by which her form has been developed, and upon these lines meeting the water parallel depends the success of the draught; but so fickle is salt water that she may not like so much ballast as would bring her down to an inch or so of this line, and perhaps she might like more; and instances have been known of two vessels built from the same draught, and rigged similarly in every respect, that required a different line of flotation, and a different arrangement of ballast to make them perform well. But it is always advisable to try a vessel well as ballasted, and brought down in the water according to her construction draught, before any change in the weights takes place; there may be some fault in her building that has caused a corresponding divergence from the Architect's draught; and an alteration of ballast may make this all right when she is afloat; but the moment her correct trim is found, not a block should be stirred.

When at the conclusion of a season a vessel is laid up, and that it may be desirable to remove the ballast from her in order to effect a thorough cleansing, the utmost circumspection is requisite in taking it

out of her: every block should be marked, so that it may be known where it came from, that when it comes to be re-stowed, a perfect similar re-arrangement of the weights may be accomplished. I have known of vessels being thrown out of a perfect trim that was never afterwards recovered, through a neglect of this precaution: and there is nothing so ticklish as meddlng with the ballast after its correct stowage has been arranged.

I have heard many wonderful anecdotes of swinging ballast, that is, ballast swung from ring bolts in the beams, or stringers of the main cabin;—we all have heard of shot being put in hammocks on board men-of-war, and such like expedients, when extra speed was requisite in chasing an enemy; this expedient can only I think be of benefit in a smooth sea and with light winds; under such circumstances I have seen it tried twice in racing, and as far as my recollection goes we did experience an advantage from it; we slung a hammock to a spar placed across the main skylight, and in this hammock stowed about two cwt. of ballast: the sea was comparatively smooth, with an occasional heave, and a few rippling waves; keeping the hammock on a gentle swing fore and aft, we certainly did forge considerably ahead of a vessel that had hitherto pushed us very closely. Upon the second occasion there was merely as much wind as kept our sails sleeping, and there was a little jobble of a sea caused by an easy tide running over a rough bottom; we set the hammock full of ballast again in motion, and she forged away from her antagonist in capital style.

Upon the whole, however, I think that a vessel of a good form, to which a minute attention has been paid in the construction and finish of the hull; the stowage of the ballast, the sparring, canvassing, rigging, and last, tho' not least, the handling will be found to perform after a manner that will defy all such little artifices of the sea; their effects are never certain, for what may make one craft go will make another stop and kick her tiller under her bobstay. I certainly agree with the theory of an artificial spring in the ballast, but it must not be left to the chance, and the very remote one of cork shavings, broom tops, and India-rubber bricks retaining their elasticity; if its action is not secured effectively at all times, it is useless,—if it can, and I see nothing to hinder it according to the plan I have suggested, I feel assured it would much benefit a yacht, either for racing or cruising.

## CHAPTER XXVI.

"For only what is sound and strong,
To this vessel shall belong;
Cedar of Maine and Georgia pine,
Here together shall combine."—LONGFELLOW.

As I have on many occasions when writing of various details about the deck of a yacht, mentioned that all fittings upon the deck should be kept as low as possible, I will here take the opportunity of specifying some general particulars about deck fittings that may be found useful. Commencing at the stem we will proceed aft, taking in detail such matters, as experience of their defects or ill-adaptation to the duties required of them, have from time to time come under my notice, or been pointed out to me by yachtsmen friends. Firstly, then we will take the gammon iron or band for the bowsprit bolted to the stem; this iron should be made so that the bowsprit may fit in it quite loosely; the spar should play from the bitts in the bowsprit guys, and not from the common gammon iron: the bowsprit should pass in and out through it quite freely, so that when it may become necessary to reef it, the bowsprit can be hove out easily to withdraw the fid, and then that a very slight pull on the bowsprit guys brings the spar into the extent of the reef (that is if it is not fitted with a reefing rack and pinion, which will be found extremely useful, and which every cutter yacht's bowsprit should be fitted with). The stem should be bearded off on the fore-side of the gammon iron, so as to obviate the chance of the jib traveller getting jammed between it and the iron, when the jib is let fly in-board suddenly.

The score cut in the front of the stem to receive the forestay should be rounded at its junction with the hole bored through the stem for the stay to reeve through, just like the sheave of a block, so that no shoulder or angle may exist, as if there does, the stay, whether of hemp or iron, will be nipped thereupon, and when a heavy strain comes upon it, it will be so weakened and strained upon this shoulder, that the chances are in favour of its parting at this spot, an occurrence which

I have seen take place upon more than one occasion, thereby risking the loss of the mast and the limbs and lives of those on board. The stay too should be well and closely served, and if it is leathered over all in the wake of this score, so much the better; it will be found useful when the stay has been hove down to its proper tautness, which will be discovered from the performance of a vessel, to mark its length, on the inside of the stem, with a round seizing corresponding with some mark on the deck, so that when it may be eased up for any purpose, or that the vessel is fitting out after a winter's lying up, the stay may be hove down to exactly the same length and tautness as before, of course allowance being made for its stretching.

It will be found to facilitate the working of the chain cables considerably, if two iron rollers are fitted in good solid iron bolt bearings, just abaft of the hawse pipes on deck, so that the chains instead of working on the lower part of the hawse pipes, may work upon these metal rollers; when they work upon the hawse pipes alone, a nip and corresponding strain is put upon the chain, and oftentimes proves a great obstacle to the heaving the anchor loose from the ground, whereas with the rollers the cables will work easily and smoothly, and the anchor come to the bows with much less manual exertion at the windlass.

With respect to this latter part of a yacht's fitting on deck, viz.:—the windlass, I think a very erroneous principle has existed as to its proper position; in most of the yachts built heretofore, the windlass is placed right forward in their bows, so that the bitts to receive the end of the bowsprit form part and parcel of, or are sometimes placed chock against it; now a yacht's windlass is of considerable weight, and if we are particular in taking care that no weights are placed forward below, how much more is it necessary to extend this precaution and foresight to the deck, where in addition to the weight being so far forward, in fact in a vessel's eyes, the injurious top hamper weight in a place where a vessel is the least supported by the water, tends not only to pin her head down when a heavy sea breaks upon her forecastle, but must strain her considerably in addition to the weight of her bowsprit, and that of the mast and sails depending on the forestay rove through her stem. For these reasons a windlass should always be placed as near to the mast as possible, thus its weight will be brought more into the body of the vessel, and when she careens to the breeze there will be greater bearings below to support it; this position will not in the least interfere

with its power or effectiveness in working, and any objection to the extra length of chain lying along the deck, leading to the hawse pipes, when a vessel is at anchor, cannot weigh in comparison to the immense benefit to be derived from its being placed in this position; and now when all chain cables are galvanized, there cannot be any danger of the rust from chains discolouring the purity of the decks.

The bitts to receive the heel of the bowsprit will then be the only weight very far forward, and of such a trivial nature as to be of little consequence. As a really good, well put together, easily working, and powerful windlass, is of the utmost importance on board a yacht; the greatest care and attention should be paid to the construction of its component parts, and the putting together of them, so that any great strain put upon the machine when heaving a vessel up to her anchor, or breaking its hold in the ground, may be evenly distributed of the entire, and not concentrated in one spot through the misfitting or careless gearing of the parts; a proper windlass should work as kindly and easily to the hand as the main-spring of a watch to the power of the key; but if any jerking or uneven motion is perceptible, it is a certain token of a faultily built and bad windlass. There are many patent windlasses now constructed on very excellent plans, but those that are simplest in form, and have the least complication of wheels or motive gear, are generally found to be the best.

Windlasses should always be fitted with Gryll's patent whelps on the barrels, which valuable invention always keeps the chain cable in an even position on the barrel when being hove in, and prevents fleeting and surging, so that one continuous heave may be kept up by the crew until the anchor is at the bows; these patents whelps are now in general use for both capstans and windlasses. Of patent windlasses I have seen some very fine and effective ones made by Wood Brothers, of Liverpool; and their O D windlass-purchase with patent barrel spindle, is one well adapted both in strength and lightness for a yacht. There is also an invention of Gryll's viz. :—a patent cable stopper that might be found of very great use in a large yacht. By placing a windlass close to the mast it also affords ample room for the crew to work it; and if there should not be a winch fitted to the spider hoop of the mast, when occasion arises for a powerful pull on the halliards, or tack tackle, gaff-topsail tack, or reef tackle, the windlass may with advantage be made to perform the duty.

The fore-scuttle or hatchway for the crew on the forecastle should be made low, strong, and perfectly water-tight; this latter precaution in its construction is eminently necessary, so that in heavy weather when it is closed it may be completely battened down; the lid should slide in brass grooves, or be well hinged, and have weather flaps on the sides; a lid that merely drops on is a bad plan, it may be washed overboard and lost, and there are not always means convenient to keep a breaking sea out. I have seen vessels, both racing and cruising, suffer great inconvenience, and take a quantity of water down through the forecastle hatch, in consequence of a faultily constructed cover that let in the water, or from having a loose one washed away; under such circumstances the forecastle is rendered wet and most uncomfortable for the crew, their clothes drenched, provisions injured, and hammocks in a mess, and as Jack likes to be drily and comfortably berthed after his fashion, quite as well as his master, a little precaution under this head may save grumbling and inconvenience, and preserve cheerfulness before the mast; a matter of no mean consideration to those who wish to be at ease aft. It is a good plan to have a narrowly framed loose wooden grating, pretty strong, so as to bear a man's standing upon it, to fit over the hatchway, so that in fine weather air may be admitted freely below to the watch that are in their hammocks; this is very necessary at night time, as the forecastle is often close, and the atmosphere oppressive; and if a small scuttle be cut in the deck well forward, so as to give circulation, and thus drive out foul air, it will be found of great benefit. Lying in harbour this grating will be found additionally useful in keeping out rats, pests that are very fond of boarding yachts when opportunity offers, and as equally difficult to get rid of. In rainy weather a little oil skin awning in the shape of the letter A, triced to the forestay, and seized to eyes in the sides of the hatch coaming, will prevent the wet going through the grating, and at the same time not prevent a man coming on deck.

For the same reasons of preventing rats or water getting below, the chain cable pipes on deck should be fitted with slip stoppers to slide in a groove down on the chain links, and thus close them effectively; others canvas caps or collars must be seized over the pipes, which substitutes neither answer well nor prove as serviceable.

The bitts by the mast for leading and belaying the peak and main halliards to, should be stout, strongly fitted, and kept low, and the kevel heads of sufficient length to take the turns of the ropes when belayed;

if the heads be cut too short, a stiff or new rope may fly off, and the sail come down by the run; the sheaves for leading the halliards under at the feet of the bitts, should be stout and of the full size to take the rope without jamming it in the score, and they should play freely on their pins.

Neat mahogany or oak railed cradles will be found very convenient for coiling the falls of both peak and main halliards into; these prevent the falls when coiled down getting adrift about the decks, particularly during a dark night and dirty weather, when it is especially necessary that important ropes may be kept all clear and ready for running in any sudden emergency, they may be lashed to small eye bolts in the deck, just abaft the mast on either side; if these cradles are made with hinges to the sides and ends, they can be folded up and stowed away below when not required.

It is of great necessity that there should be an opening in the deck just above the cooking galley; in schooners that have a fore-cabin, this can be accomplished by running the fore-skylight further forward, and making it light the steward's pantry, and ventilate the gallery at the same time; but in cutters this would disfigure the deck with too long a skylight; so that there must be a small hatch cut, or what is neater still, an extra large screw dead light inserted in the deck, nothing can be more offensive than the stale odour of cooking, but with this skylight or hatch over the galley it is got rid of at once, and the'tween decks kept free from unpleasant heat and foul atmosphere.

The pin racks bolted to the stanchions abreast of the mast, should be of sufficient width to allow ropes to be freely belayed, sometimes they are put in so narrow that the heads of the belaying pins are jammed against the bulwark rail, or so close to it that it is with difficulty a rope can be either belayed or cast off from them.

A neat shroud cleat should be seized upon the after-shroud on each side for the purpose of belaying the signal halliards upon; it is a general practice to belay these halliards upon the pin rack or to the sheer pole on either side, but it is inconvenient in the extreme, for very often they get entangled with the other falls, or jammed into the running blocks of the purchases, thereby causing much confusion and delay, more particularly when housing or sending aloft the top-mast. Shroud cleats seized about breast high on the after part of both port and starboard shrouds, obviate this inconvenience, and a man knows at once where to lay his

hand upon the signal halliard falls, even in the dark. Often, too, when belayed upon the pin rack other ropes are belayed over them, and then if the topmast has to be housed or sent up suddenly, or the burgee dipped, or a signal made, it proves extremely awkward, and such details, trivial though they be, are subversive to that disciplined smartness that should ever characterise the handling of a yacht.

With respect to the skylights, as I have before said, they cannot be kept too low upon a yacht's deck. Nothing can be more unsightly than tall, unwieldly-looking edifices of wood and glass, or more detractive from the neat and flush appearance that a deck should present. The skylights with upright sides, and A tops so commonly seen in yachts, are about the very worst and most ugly form that can be adopted. The elliptical roofed skylights springing clear from the deck on either side and kept very low, with upright ends, are the neatest and strongest that can be made. These skylights should be made with the glass flaps strongly hinged, with moveable rivet hinges, upon a very strong ridge piece, and doubly countersunk in it and at the ends, so as to admit of mahogany or oak diamond grating flaps being fitted over them, similarly hinged, and folding down flush with the ends, which should stand up level with them. By the moveable rivet hinges these grating flaps can be removed and stowed away when required, if lying in harbour, and when racing the plate-glass flaps can be removed and replaced by wooden ones fitted with dead lights. Water channels should be countersunk in the ridge piece and at the ends, beneath the joints of these flaps, so as to carry off any leakage; solid pieces in the shape of an O G moulding screwed internally to the upright ends, will form good beds for the flaps to rest upon, afford ample room for water channels, and obviate the necessity of having the end pieces so heavy and thick as to allow the water channels to be countersunk in them. The advantage of having the glass and grating flaps flush with the ends is, that no line or rope can catch under them, and lifting them suddenly, perhaps wrench them off their hinges, or smash the glass by letting the flap fall again; added to which it has a much neater appearance. By having them fitted with moveable rivets to the hinges, they can be taken off on a racing day, and then when the frame is taken off for the purpose of sending anchors, legs, sail covers, man rope stancheons, accommodation ladders, boats' davits, &c., and the thousand and one other items that are struck down into the main cabin, there will be no danger of the glass being broken,

or the handsome gratings torn or destroyed : the working wooden flaps will not take injury in sending down or getting up sails, and will form a solid deck under the men's feet that are working the ship, and at the same time admit light below. As a general rule, the smaller all openings for skylights can be made, consistent with admitting a good light, the better ; the larger and handsomer the deck will appear, and likewise possess more strength than when too much cut up.

Strong and thick oilskin covers should be fitted to each skylight for use at night time, so that no glare of light from the cabins may dazzle the eyes of the watch on deck, or confound the helmsman and distract his attention from the binnacle.

The shape of the companion, too, has a considerable effect upon the appearance on deck; very many are made perfectly square and high enough to form a seat; but these look extremely clumsy and heavy; the neatest shape is that of the elongated quadrant, kept nearly as low, if not quite, as the skylights : the half of this elongated quadrant slides back on countersunk brass groves, so that it is perfectly water-tight, and a slide panel in the front of the companion, fitted also in brass grooves, effectually closes it at night time. In warm weather a grated panel will be found a useful substitute for the latter, so as to admit plenty of air below, and to prevent at the same time the advent of such unwelcome visitors as harbour rats. Glass panels in the sides of companions is an error, they may get broken, and then should heavy weather come on suddenly before they can be repaired, the first swash of a sea upon deck deluges the companion stairs and cabin.

There cannot be a greater source of discomfort and annoyance on board a yacht than leaky skylights or a leaky, badly-put-together companion, and there never existed a greater eyesore upon deck than coarse, heavy, unfinished looking work in this respect. Many a fine yacht have I seen rendered positively ugly and cheerless-looking by a grim arrangement of pigeon boxes and dog-kennels that looked as if they had fallen during a passing shower, and were kicked into their positions to get rid of them out of the way. This department of a yacht's fittings should receive more general attention than it does, both in selecting elegance of form, and securing excellence of workmanship. Strictly speaking, these fittings come within the province of a cabinet-maker, and I never saw any that approached my notion of completeness, both in design and finish, that did not come from the hands of a clever artizan in that

branch of wood work. They must be made of the very cleanest and most seasoned timber, otherwise they will warp and become loose, and any extra expense that may be incurred in getting them properly constructed and fitted will well repay the yachtsman from their superior appearance, and the comfort that will be derived from their perfect adaptation to the purposes required.

The sail-room hatch is oftentimes constructed so that the top presents the appearance of part of the deck; this is effected by selecting clean pieces of pine corresponding in colour with the deck plank, and grooving them to match the deck seaming, paying these grooves with a similar mixture as the seams; this preserves a large and flush appearance of the quarter-deck abaft the ladies' saloon skylight, and gets rid of that cut-up look that a mahogany or oak top very often suggests.

A very excellent plan for converting the sail-room into a temporary cock-pit for the helmsman, was brought under my notice by a yachtsman friend, and I give it here for the benefit of such of my readers as it may concern: when the top of the hatch is taken off, a stout wooden tray that slides in strong wooden grooves underneath the deck, is drawn forward, so that the steersman can stand down in it up to his waist, and thus have an opportunity of seeing under the sails. This plan may be found very useful in small vessels, and gives the helmsman a good secure berth when the tiller is low, and even in large vessels it would be of much avail when harbour or river sailing, or in a crowded anchorage, when the man at the tiller found it desirable to command a clear view all round him. When this tray or jury cock-pit is shoved back, there being only three sides and the bottom to it, it forms a convenient shelf for stowing away articles in the sail room that are necessary of immediate access.

The next portion of the deck-fittings that demand observation are the dead lights: the old-fashioned square plain glass dead lights, puttied in flush with the deck, have, I may say, entirely given way to the circular brass framed screw dead lights. The great advantage of the latter are that by them complete ventilation is secured below during the fine weather, for upon unscrewing the glass light from the deck there is a neat open work brass frame that screws into its place, thus allowing the free ingress of fresh air, and at the same time precluding the possibility of accident by a man's foot slipping through the orifice; these lights are also fitted with japanned drip pans having plate-glass bottoms,

that hook on to small brass eye-bolts screwed in the under part of the deck, so as to catch any wet that may penetrate along the threads of the screw-frame during wet weather, and at the same time to permit the free admission of light. There are also a larger and stronger description of side lights which are hinged, and close with a powerful screw on a cork flange which prevents any water getting through; these are used for putting in the sides of a vessel, and are countersunk so as to prevent their being broken by a boat coming alongside, or when lying alongside another vessel or a quay. Of these lights, Mr. Pascall Atkey, of West Cowes, the well-known yachts' chandler, has the most varied and best assortment; and, in fact, in every department that embraces brass or iron fittings of complete design and finish, his establishment is well worthy of a visit.

## CHAPTER XXVII.

"They laid him in a boat and plied the oar,
Until they reached some galliats, placed in line,
On board of one of these, and under hatches,
They stowed him with strict orders to the watches."—BYRON.

THE economy of the 'tween decks should be well considered and determined upon, so that all available space may be made proper use of, and the acommodation afforded in departments equivalent to the space allocated. It would be useless to lay down any specific rules for guidance under this head, there being so many different ideas, and various individual tastes; but I shall endeavour to give a general view of the arrangements that have been found most excellent and convenient on board many first-rate vessels. We shall begin with the forecastle. In proportioning the size of this department regard should be had to the number of men it is to accommodate, and as they have to eat, drink, sleep and cleanse themselves, therein, it is advisable to afford to it every space that can be spared from the after cabins without absolutely cramping them: underneath the flooring of the cabin it is usual to have the coke bunkers: these should be boarded in carefully so that none of the shingle or grit of the coke may get below into the run of the vessel, thereby tending to choke the limber holes and the ends of pump pipes, and injure the pump cases themselves; strict injunctions should be given and observed that no slops or cooking water may be thrown into them, or below in any part of the forecastle, by the crew or the cook, such practices engendering foul and putrid odours and accumulating dirt that much interferes with health and personal comfort. The flooring of the forecastle should be made in separate pieces of a portable size and of narrow clean yellow or white pine put together, similar to deck planking; this arrangement makes the cabin look extremely neat and well finished, and when the deck is being scrubbed in the morning these floorings should be hauled up in the forecastle and well scrubbed at the same time: by being thus regularly removed

the fore part of the vessel will be well ventilated, and any contravention of orders with respect to throwing down foul water, or cook's rubbish will at once be perceived. There should be lockers placed all round the forecastle fitted with locks and keys, a locker devöted to each man of the crew for keeping his clothes, &c., in, and some spare ones for boatswain's stores, &c., besides a couple of large ones for stowing away the hammocks and bedding in the day time; or if thought better these latter may be neatly made up and triced to the beams, but some yachtsmen like them to be stowed away, so that the forecastle may have a clear, large, and lightsome appearance; a good sized bread locker lined with tin must not be forgotten, and if the space will admit of it, and I am now writing for a class of vessels that it will, this is most essential for cleanliness, health, and, though last not least, the observance of those decencies which I am sure no yachtsman would willingly permit the violation of.

A separate pump attached to the bitt leggs for the use of the men, a good serviceable looking glass, and iron porcelain lined, or japanned tin washing utensils, it is also well to provide for them: in fact every facility towards cleanliness and order in their persons and habits should be afforded, and thus having a place for everything provided, with all the requisites for their personal accommodation, there can be no excuse for slovenliness and neglect.. The tops of the lockers will form bench seats and there should be a neat folding table for the crew to take their meals off, each man being provided with his plate, bowl, cup, and drinking flagon of pewter, or iron porcelain lined ware, together with knife and fork, spook, &c., so that the steward's pantry may not in any way be encroached upon to supply the wants of the forecastle.

In the case of a meat safe being carried upon deck, which in fact is almost essential, one half of it should be apportioned for the crew's provisions to be kept in, such as cooked meat, butter, &c., or a pantry safe for them constructed in the vicinity of the steward's pantry. If this necessary accommodation be not afforded they will be stowed in out of the way places, speedily became bad, give rise to foul smells, and become unwholesome and nauseous for the men to eat. In placing the pumps for their use in the bitt leg it will be removed from the vicinity of the cooking galley, and the water kept cool and fit for their drinking, and it involves but the few extra feet of leaden pipe that connects it with the tanks.

I have before adverted to the cutting of a small hatch in the deck forward under the heel of the bowsprit, or a large screw dead light will answer better. If such a precaution be not taken the forecastle will be but imperfectly ventilated, even with the aid of a windsail, and will in proportion be but uncomfortable and unhealthy for the crew, but with such a hatch or dead light all the foul air and heat generated by cooking, and the assemblage of a number of men in such a necessarily limited space, will be cleared away, the cabin kept cool and pleasant, and should it be requisite to keep the galley fire lighted for the purpose of late cooking for the main saloon, for hot water, or in the case of illness on board, the inconvenience will not be near so much felt by the watch in their hammocks: if to this be added a couple of screw dead lights in the free-board of the sides of the vessel the ventilation of the forecastle will be complete, but as many men object to these for spoiling the external appearance, and as they can be seldom used when under weigh, a windsail may probably be found nearly as serviceable. If at all practicable the cooking galley should be separate from the forecastle, even if it is only by half a bulkhead, and indeed the latter may be preferred to a whole one as securing better ventilation, the space in which it is enclosed lined with zinc or lead, and all the cook's paraphernalia confined to the limits of the galley cabin. By such a disposal of room matters can be kept more in their proper places, the cook will not be disturbed in his avocations, nor the sailors interfered with in their leasure or duties below; cleanliness will moreover be promoted, as I need hardly say contact with the necessaries of the *cuisine* do not improve the spotless purity of duck trowsers or frocks, and pilot cloth seems to be particularly susceptible of grease stains and fire spark burns.

If a separate space cannot be devoted to a galley cabin, the next best plan is to form such a recess for it between the captain's cabin and the steward's pantry, as will have the effect of removing it as far as possible from that part of the forecastle occupied by the crew. It is a very bad plan to have the cooking galley forward in the forecastle, or in the centre of it; when in such a position there seldom, if ever, can be a clean cabin, and everything in use by the cook is knocking about amongst the men's things, creating no end of a mess and confusion. In the absence of a galley cabin, there should always be a roomy locker set apart for holding all cooking gear not in use; some-

times these are strewed in the lower part of the steward's pantry, but it is not advisable on the score of cleanliness. As the galley placed in the position I have recommended must necessarily be close to the mast in cutters, it is advisable to attend to the lead or zinc sheeting around it, in order to prevent the possibility of fire; it is also a good precaution to have a foot or so of the forecastle platform sheeted with lead outside of the metal ash pan of the galley stove, and also to go underneath it; the galley stove itself should be firmly secured to the platform by screw stays, in order to prevent its fetching away when the vessel is in a heavy seaway. It is a very good plan to have a locker made of japanned tin or zinc to fit round the galley funnel, in order therein to air linen or wearing apparel that may be liable to suffer from damp.

Mr. Pascall Atkey of Cowes, and Mr. Williams of Torquay, manufacture the best cooking galleys for yachts purposes that I have yet seen; they are complete in every respect, and possibly Mr. Williams may have a slight advantage over Mr. Atkey, in that his galley stove of smaller dimensions performs equally as much work, and as every inch of room is an object, this may be fairly considered of some advantage; otherwise it is hard to choose between them.

The captain should have a roomy cabin appropriated to him, not only to give him his requisite position in the estimation of the crew, but as he ought to have a proper amount of room for his charts, books, and nautical instruments; as he has not only to live in this cabin but to perform all the duties connected with the navigation of the vessel, a good sized folding table will be requisite in it for the purpose of spreading out charts, making calculations, writing up the log, &c.: it should be furnished with all the requisites for personal comfort, and in addition a first-rate tell-tale compass fitted with an illuminating lamp, so that by day or night when not on deck he may be enabled to check the helmsman in his steering; there should also be a Barometer and Sympiesometer; it is very inconvenient when these instruments are only supplied to the main saloon; a sailing master (unless a vessel be of sufficient size and importance to command the services of a naval officer or captain in the mercantile marine) does not like intruding upon his owner and guests at moments when they may be enjoying themselves, in order to ascertain how the glass stands, and consequently there may be what might perhaps come under the designation of compelled neglect

of warnings that should be most carefully noted: if these instruments therefore are furnished to his cabin they are always before his eyes, and he is induced to note their fluctuations more accurately, a practice that should be strictly adhered to by every yacht captain. There should also be a good binocular sea glass, the old-fashioned long telescope has now become exploded, for it is next to impossible to get a steady sight with it from the deck of a yacht whereas, a binocular glass held with both hands enables the observer to catch his object in a moment: one of Captain Toynbee's No. 1, Parallel Rulers, the best of the description I have ever seen, an Opisometer, which is a little instrument that will be found much more convenient for measuring distances on a chart than the usual dividers, a pair of dividers having a moveable pencil leg, a Gunter's Scale, the Nautical Almanack, Raper's Navigation, Commercial Code, Signal Book, Hunt's Universal Yacht List, a Log Slate, a Log Book, and a collection of charts; Massey's Patent Log, a common Log, with glasses, a Sextant, and Berthon's Inclinometers; these will constitute the most important items in the fitting of the captain's cabin. Berthon's Patent Log is an admirable invention and particularly suitable for yachts, but its expense and the trouble of fitting it to a vessel is very much against its more general adoption.

The steward's pantry which is generally opposite to the captain's cabin, thereby giving ready access to the cooking galley, should be fitted with shelves so arranged that every article pertaining to breakfast, dinner, and tea services may have their distinct positions assigned them, and be returned in their places by vertical ledges so that no matter how the vessel rolls or pitches none of them can be displaced or broken; tumblers and glasses should be fitted in perforated racks that will hold them securely: any cupboards or presses adjoining the pantry fitted for steward's stores should have their shelves placed at an angle of 45 degrees, so that no matter what articles may be placed upon them they will not roll off when the vessel is inclined; a good water filter is indispensible in this department, as also a patent draw pump connected with the fresh water tanks; it is a great mistake having this draw pump placed as it very often is in the forecastle and close beside the galley fire; the water gets hot and unpleasant to drink, from the pumps becoming heated in consequence of its proximity to the fire; it should always be fitted in the steward's pantry where it will be found much more convenient, and the water kept cool. A small slate ice well can

be fitted under the flooring of the steward's pantry, and may be found very useful to ice wine, or keep meat, fish or fowl cool in hot weather. Grapes or other fruit suspended for a short time in such a well will be found very refreshing in hot latitudes. Sometimes a berth is fitted for the steward in the under section of the pantry, concealed during the day time by sliding jalousied doors; but many yachtsmen prefer having a hammock slung for that official in the forecastle in preference to his sleeping where sundry articles of food, and condiments are kept.

Good swinging oil lamps should be fitted to the forecastle, captain's cabin, and pantry, as during cruising times they may be required a-light all night. Sometimes there are hanging presses fitted near the mast close to the galley stove for the purpose of drying and keeping aired pea-jackets, rough trowsers, worsted comforters and sea stockings, and it is by no means a bad plan if they can be conveniently arranged without interfering with the chain cables and chain lockers. In general from six feet six inches to seven feet is the allowance for the length of berth, so this measure will be a guide for the captain's cabin and pantry. In the long bowed vessels that are now built, the masts not being stepped so far forward, ample room can be found for fitting the cooking galley as I have described between them.

In cutters the main saloon comes next in order: from eleven to twelve feet will be found a good length for this apartment, this will give seven feet for the length of the sofa's and two feet six inches each for the width of the buffets at each end. With regard to the fittings of this cabin a good deal depends upon the particular taste of the owner; some have it pannelled so as to preserve the appearance of the sweep of the sides of the vessel, but there is no doubt the square pannelling so as to preserve the appearance of a room is the best. An experienced yachtsman friend of mine who has always displayed considerable taste in the fittings of his cabin holds it as a rule that by keeping the panels at the sides of the vessel perpendicular it gives an appearance of much greater size to the apartment; as the eye instead of being carried by the curve of the vessel's side is deceived, and retains the impression of the cabin being a square room as large as if the sofas were not in position at all; this I have observed myself in comparing the cabins of two yachts thus differently fitted, the square pannelled cabin in general looking of a much greater size than the one fitted with carved panels.

In the arrangement of the sofas and buffets in the saloon it makes a

very neat and light looking finish to have the ends of the sofas where they join the buffets, instead of being square, fashioned with an O G sweep; and the buffets finished at the top with a narrow and low open work ledge. In arranging the height of the sofas when cushioned, the first thing to look to is the junction of the cabin floor with the bilge of the vessel; from this junction the front parts of the sofas should be raised, and the higher these parts are raised the broader will be the seats: the backs of the sofas should be laid close against the sheating of the vessel's sides, so as to allow no room to be lost. Sometimes lockers are formed at the backs of the sofas, but they are so narrow and confined as to be perfectly useless, except for holding charts, and from being so inconvenient to get at, are but seldom of use even for this purpose: they are fertile recepticles though for all sorts of rubbish that a careless steward may wish to get hurriedly out of his way, and in fact are much better done without. Lockers under the sofas themselves are useful, but should be only used for stores, such as preserved meats, and soups, wine, &c.; if otherwise made use of they will be found extremely inconvenient, as the cushions having to be taken off to get at the lids, will involve the necessity of disturbing any party that may be assembled in the cabin: if the size of the vessel admits of sufficient store rooms without these lockers, the better way is do without them, and leave the fronts of the sofas open, thus securing free ventilation with the sides of the vessel.

Looking glasses make a cabin look double its real size, and two neat book cases may be constructed over the buffets with looking glass panels in the doors; if there are looking glass panels fitted over the sofas it will still further increase the delusion, and I do not know of any more elegant mode of fitting a saloon; these glass panels may be fitted with wooden shields for cruising purposes; the looking glasses should be fitted in with India rubber pads round the edges so as to deaden any sudden shock, and lessen the chance of breakage. I have seen vessels fitted with looking glass panels however go through an immense amount of rough work, and never sustain the slightest damage, beyond leakage at the back when they were not properly backed with water tight cases; this leakage, which often occurs from the topsides either working or being imperfectly caulked can however be thoroughly guarded against by having the panels fitted in water proof cases before they are placed in their frames.

Birds-eye maple panels with light coloured mahogany styles make very neat fittings for a saloon; satin wood and rosewood styles is another contrast; all mahogany looks too solid and heavy, but I think the richest fittings I ever saw were made of walnut wood, French polished. In general polished wood fittings are to be preferred to painted work in a saloon; paint is so hard to keep in order, and has to be renewed every season, whereas polished wood will last the vessel out, and the first expense will in the end be found the most economical. Carved woodwork ornamental decorations should be but sparingly used; they catch dust and are very hard to keep clean, besides giving a cabin too much the appearance of elaborately got up upholstery; the neater and plainer its workmanship is executed, having regard to the harmonious combination of colours in the wood with which it is fitted, and the velvet, or cloth of the sofas, the more chaste and elegant it will look, and gilt beading should be very sparingly used indeed.

## CHAPTER XXVIII.

"All is finished! and at length
Has come the bridal day
Of beauty and of strength,
To day the vessel shall be launched!
And o'er the bay
Slowly, in all its splendour dight
The great sun rises to behold the sight."—LONGFELLOW.

HAVING now gone pretty well through the various details of a yacht previous to her leaving the stocks, I shall next endeavour to draw attention to the several matters connected with the noble pastime which we so peculiarly claim as our own, and in which no other country can rival us. The greater portion of what I have already written applies more particularly to that department which may be termed the Nautical Turf; as treating upon the best methods of bringing yachts out properly fitted for the purpose of successfully contending in races; the succeeding chapters I shall devote to the establishment of a yacht afloat, and in doing so will endeavour to show that the cruising and racing can be combined, without entailing any serious inconvenience by interfering with the usual routine, or causing any diminution to the personal comfort of those on board.

The general impression about a racing yacht is, that to be eminently successful, she must be entirely devoted to that pursuit, and that nearly all the essentials necessary for the personal comfort of the owner and his friends on board, must, if not entirely be dispensed with, be at least considerably abrogated. Instances may be multiplied no doubt in which such has been the case heretofore, where yachts have been almost entirely denuded of their cruising fittings, and proceeded from port to port, regatta to regatta, in charge of their crews alone; owners and friends availing themselves of land transit to join them at the various contests they might be engaged in; but seldom proceeding in them until the racing season was over, when racing canvas being replaced by cruising suits of more moderate dimensions, they become the staid, quiet going craft, clipped of their wings, and more capable of contending with

the varieties of weather to be encountered around our coasts, or on a voyage to the Mediterranean.

Such craft have enjoyed the reputation of mere racing-machines, but our experience of them tends to show that much exaggeration has existed with respect to them, and their performances during heavy weather, whilst engaged in match sailing, goes far to prove that if handled with the same care and attention whilst cruising the results would establish a confidence in them as to their seagoing abilities, the doubt of which has hitherto caused them to be looked upon in the light of dangerous, wet, and uncomfortable vessels. A great deal of the erroneous impressions entertained under this head, is due to the fact that we looked upon yacht racing as being an exhibition of dare devil hardihood, that yielded to no obstacle in the shape of wind or sea; that vessels must be driven through the water by means of a spread of canvas incompatible with safety; that cabin fittings interfered with sailing qualities, and that nothing but a contest between the ballast below and the canvas aloft, the one to keep a vessel on her legs, and the other to drive her along, could ensure a perfectly successful racing yacht.

Let us look at the old fashioned yachts with their bluff bows, great beam, and comparatively short lengths. Many of us can remember when these vessels, that now-a-days we dignify by the name of slow tubs, were regarded as particularly dangerous and wet vessels, as racers; and simply so when engaged in racing; but as cruisers they were considered all that was correct, in point of fact it was with such vessels that the distinction between racing and cruising yachts originated, to drive their large hulls through the water at any respectable rate of speed, longer and heavier spars and a greater spread of canvas became requisite, which owing to their slowness, contingent upon their form, caused them to labour heavily; for it was a war between the canvas urging, and the bluff hull retarding their passage through the water. To the present day such vessels are quoted as fine, able, dry, and safe seagoing, simply because under moderate sail they lifted to a sea, as if lying to; but made slow progress through it; their want of speed constituted their sea worthiness, and then when speed came to be imparted to them by means of a mountain of canvas, lo! we had the wet uncomfortable racers.

Next came upon the scene the deep sharp vessels, introduced first by that veteran builder Wanhill of Poole, and with them sprang up the system of building vessels that should give great accommodation aloft,

with the smallest tonnage measurement that a raking sternpost would give; with short keels and shortened water lines below, these vessels had still to preserve a respectable rotundity of body; their deep draught of water enabled the ballast to be placed low down, but still the proportion of spars kept pace with their more old fashioned sisters, and in some instances exceeded them; we could not afford to abate one foot of spar, or one yard of canvas, and with smaller and sharper hulls below, and greater weight aloft, we were obliged to have recourse to that bane of yachting—shifting ballast. By means of shifting ballast alone could such vessels be made to stand up to their canvas, and both canvas and ballast proving too much for the deep sharp hulls, we began to regard racing yachts as mere machines to be cheated along as fast as fortuitous circumstances, daring seamanship, and consummate skill could achieve. Another change came over us, and many of these very vessels are looked upon now as bluff and tub shaped, in comparison with modern clippers: the idea appears to have gradually gained ground that, reducing the amount of canvas to meet the circumstances of weather, enabled a vessel to go along faster and drier in a heavy sea: then came the introduction of fine and long bows upon the American principle, and we began to do away with the enormous bowsprits and huge working jibs, and to round up the fore-foot, the former depth of which caused a vessel to gripe, and necessitated her carrying the aforesaid enormous jibs, in order to keep her from rounding bodily into the wind's eye when close hauled.

Many instances have practically demonstrated to yachtsmen during late years, that a vessel will work better to windward under snug head canvas than any other: from this fact holding good as to one end of a ship, it follows that a proper diminution of canvas throughout would materially assist a vessel's speed under any or all circumstances; and that by reducing both spars and canvas, and getting rid of a portion of our "cargo" of ballast, the same, if not a higher, rate of speed can be attained, and the seagoing powers of a vessel preserved in their entirety. I believe that this conviction has been gradually indulged in of late, but its sound common sense and truth we have not yet fully admitted.

I rather think that a better and more careful system of sailing and handling vessels in races has had more to do with inducing this conviction than anything else; formerly during a contest it was pack on everything, carry on like grim death, pile up ballast, do anything, everything, so that there was plenty of noise and bustle about the decks, and

lots of work going on, all to make the vessel go; the question is did it make a vessel go at all? It partook more of the character of putting a plough boy so ride a thorough bred horse, who by shouts, grimaces, and the incessant swaying about of body and limbs urges the confused and startled animal along at a floundering pace, instead of the quiet undemonstrative skill exerted by a professional jockey, who sitting close to his pig-skin, watches every movement of his animal, gets him quietly into his stride, shakes him up occasionally to renewed exertion, and is ready with hand and voice to help him when occasion requires it.

We are getting to understand that a little more attention to the handling and sailing of a yacht will tend more to her success, and enable us to get rid of much of our overwhelming canvas,—as we reduce that and our spars, we avoid the necessity of shifting ballast, and the hitherto deemed wet and uncomfortable racer is becoming, and can be made, everything that a cruising yachtsman may desire. Would any cruising yachtsman drive his vessel through such weather and water with the same amount of canvas as we have seen displayed at many regattas; would he not deem such a proceeding as savouring of madness; carrying on under certain circumstances is of course not only admissable but very often absolutely requisite, but then driving a vessel under water is quite a different thing; to get the maximum speed out of a yacht she should be made to go over the water, and not through it or under it, and this must be accomplished by neat and skilful handling, working every wind that blows and every sea that rolls, so as to suit her means of propulsion to the elements she has to contend with; persuasion is better than force, afloat as well as ashore, and in no case will it be found of more avail than in yacht racing.

Modern vessels, both cutters and schooners, are now being constructed fitted with spars of more respectable and appropriate proportions than formerly; canvas is also attracting more attention to its suitable dimensions. And above all the death warrant of shifting ballast is signed; with it dies out the greatest evil that has ever beset yachting; the fertile cause of the destruction of cabin furniture and fittings, and the source of all the discomfort entailed upon yachtsmen; the sole reason why yachts have been called racing machines, and why forests of spars and clouds of canvas have overpowered and rendered them dangerous; why enormous expense has been forced upon them by necessitating the employment of extra hands n the shape of ballast shifters, will by its use being abolished

be totally removed ; smart skippers and good active crews will take the merit hitherto awarded to inanimate shot bags, races will now be sailed at quite as much speed, and with much more comfort and safety, and the only difference that in a short time will exist between a day's cruise, and a day's race, may be in the latter a little more shifting of canvas, and a trifle harder work.

The internal fittings of modern built clippers has undergone considerable modification and improvement: we rarely now see the cumbrous lockers, the heavy bulkheads, the ponderously carved wood work, and altogether the mass of material, that was hitherto expended in cramped up berths, and a multiplicity of saloons, where accommodation and comfort were both sacrificed; everything is lighter, there is less boxing up of presses and cabins; and a racing vessel of the present day, can boast of as comfortable and luxuriously fitted up saloons and sleeping berths as need be desired. No doubt shifting ballast has been used, and largely too on board these vessels, but then contrivances have been adopted in the shape of shifting boards and stay beams, to prevent handsome sofas, and elaborately got up buffets being injured; the day is now gone past when whole boat loads of doors, and sofas, and tables, and lockers, will need be removed previously to a race; and with the banishment of shot bags we shall see yachts brought to their sailing trim, by means of the legitimate lead and iron beneath their platforms, and the fittings necessary to render their cabins habitable.

The great desideratum for a yachtsman on his first going afloat is to secure the services of a really good sailing master, a man of standing and professional reputation amongst his fellows, who will command respect in his position and at the same time not presume upon it, and who from his experience and known skill will be enabled to make his owner, if he be not a professional one, a good practical amateur sailor. We have at the present moment amongst the ranks of our yachtsmen, I am proud to say, many really thorough good sailors, excellent navigators, and competent to handle their vessels with any professional seaman afloat; it is a curious fact, yet not more strange than true, that I have seen many first-rate officers belonging to both the Royal and Mercantile Marine, perfectly puzzled in handling a yacht; and who have with honest manliness expressed their admiration and respect for the abilities displayed by our amateur seaman of the pleasure navy. Over and over again have I heard undisguised astonishment expressed at the

skill and discipline with which venturesome little craft like our racers and cruisers are manœuvred and worked; and the amount of canvas they carry, and weight of weather they successfully encounter, commented upon as instances worthy of comparison with the most daring feats performed by smugglers, slavers, pirates, and such like desperate skimmers of the seas. It may be very well for certain cynics to sneer at yachts, and yachting, and summer weather butterflies, and all that sort of thing; to say that yachting is only another name for genteel idleness and folly, and to pelt it with crude remarks; I tell thee miserable cynic, whoever you may be, that your shafts fall harmless, and that such sneering criticism serves rather than injures the cause that so excites you to animadversion.

The amount of money that is spent annually in producing, fitting out, and keeping in repair the magnificent fleet of yachts that England now boasts of, the number of seamen it employs, and the families it supports, answers you at once; and the spirit of Maritime adventure and enterprize it serves to keep alive amongst us, must ever tend advantageously to the welfare of a country upon whose flag the sun never sets. Look at our yachts that annually venture forth in quest of adventure; what part of the globe have not our gallant royal burgees flown in; they have been round the Horn and the Cape, to the Arctic Regions and Torrid Zone; hunters, naturalists, founders of colonies, and pioneers of commerce have been our yachtsman; and during the Crimean war, were not our butterflies of the ocean converted into barks of mercy and succour when supplies were loudly called for by the suffering troops? we must not forget either the act of a gallant yachtsman in the Mediterranean, who with his tiny guns and the bold front of a daring crew prevented a massacre of Christians by enraged fanatics. We can therefore proudly claim that yachts and yachtsmen have rendered good and loyal service to the State; and that although we may be but a pleasure navy, yet when time and circumstances create the opportunity yachtsmen are never found wanting in daring enterprise, dauntless bravery, or self-denying devotion.

But to "return to our muttons," otherwise skippers, a yachtsman, as I have said, will find it to his account to secure a good one. If his vessel is a new one a sailing master will have plenty to look after from the moment her keel is laid until she is launched; an experienced and thorough yacht sailor, will have many matters of detail closely attended

to, the neglect or trivial execution of which might be productive of inconvenience and unnecessary expense, and as the building of a vessel should be the groundwork of a yachtsman's experience, the assistance of a sailing master of this description in pointing out essentials during her construction, cannot be too highly estimated; in sparring, the cutting and fitting of the rigging, proposed methods of working running gear, the planning and fitting of the sails, &c., many valuable and practical lessons can be gained; and very often considerable outlay may be saved by the exercise of a wholesome economy of material that might otherwise be lavishly expended. Time thus devoted at the outset to master some of the professional secrets of the mould loft, the building slip, and the rope walk, will, with the aid of such a mentor, prepare a young yachtsman worthily for further progress, and beget a confidence that he will find stand him in good need. In the vicinity of all our celebrated yacht builders' slips, small vessels of the cutter class can be had at a moderate sum per day; perhaps the builder himself may have a model craft, one of the mosquito fleet, hovering about his watery domain; an occasional cruise, or if possible a daily one of a few hours, with his skipper and himself composing the crew, will form an agreeable change, and it is quite surprising the amount of practical knowledge that will be almost imperceptibly picked up during hours thus employed, when questions can be asked, and information elicited that demands more of the relations between master and pupil to arrive at, than might be agreeable to display when pacing the snowy quarter-deck of a flying 50-tonner. These hints I offer with all due respect to previous acquirements; perhaps a yachtsman might think it beneath him to investigate such matters at all, or seek for instruction in sailing after so humble a fashion; relying upon what he has already learned, or depending upon future opportunities; but my experience of the sea and its ways induce me to think that no matter how skilled one may be, there is always something yet remains worthy of learning.

There is a vast amount of valuable information dispersed about the world in detached bits that if collected would prove of incalculable worth; upon no subject is there more to be gathered than in relation to the sea, and what Old Neptune likes and dislikes; and no matter how humble the source, something may be discovered worthy of a niche in memory's temple. By thus combining as far as practical the study of the shore work, with a little practical manipulation afloat; when the

big ship is ready to receive her anxious owner, he may be enabled to jump on deck with more self confidence than if he had postponed his novitiate; he will also have made himself acquainted with the peculiarities of the man upon whom much of his comfort, and all his success as a yachtsman depends, and the knowledge that reliance can be placed in that quarter adds not a little to the pleasure anticipated.

To the sailing master the selection of the crew may most properly be confided; his local knowledge will better enable him to secure the smart and experienced hands, sober and steady withal, of which yacht's crews should be composed; and as yacht's skippers of repute have generally a numerous following of good seamen accustomed to their ways, and anxious to be employed under them, it may be inferred that a responsibility like this will rarely be abused.

A good mate adds in no small degree to the perfection of a crew, for on him depends a great deal in the shifting and making of sail, and general working of the vessel, and everything from a palm and needle to the best bower anchor should be so ordered and ready to hand, that upon the darkest night, or the most sudden emergency, no difficulty may exist in finding exactly the spare sail, or rope required. The sailing-master cannot be expected to have his eyes and hands everywhere; and as he has sometimes to be absent with his owner, or on the shore business of the yacht, it is the mate who represents him for the nonce; so that a man of more than ordinary intelligence should be selected to fill that station, and possessed of qualifications fitting him to take entire charge of the vessel if necessary. The pay of such men will be somewhat higher than is ordinarily calculated upon, but they are well worthy of it, and will more than repay the trifling excess. With a good master and a smart experienced mate a yachtsman will learn to know what real comfort and enjoyment is afloat; from the keel to the truck everything will be well ordered and attended to, and a discipline established without which perfection afloat will be difficult of attainment.

In some vessels of moderate size a boatswain is added to the "equipage," and with satisfactory results too; in fact, a grand secret in selecting a yacht's crew, but at the same time one very hard to acquire, is to secure men in some degree conversant individually with the different branches of trade required in a yacht, such as a carpenter, sailmaker, &c. If such a crew can be obtained combining these advantages with smart seamanship, a division of labour can be made highly conducive to entire efficiency.

## CHAPTER XXIX.

"The stately ship with all her daring band
To skilful Albert own'd the chief command."—FALCONER.

As to the number of hands necessary to the efficient manning of a yacht, it is difficult to define any precise rules. Some yachtsmen are guided by the principles of economy, whilst on the other hand millionaries who have everything done in man-of-war fashion, leave the question of numbers altogether to their sailing-masters, who consequently take care that there shall be no lack of stalwart seamen to perform even the most trifling duty. Much, however, depends upon the nature of the service in which a yacht is to be employed; if she is merely used for occasional short cruises in the immediate locality of a yachting station, a short complement of hands will suffice; but if she is destined to adventure the Mediterranean, the Northern Seas, the Tropics, or, further still, to double either of the Capes, then economy is short-sighted policy, and will neither conduce to the pleasure or confidence of her owner and his friends, or ensure a willing and contented crew. To secure the successful accomplishment of such lengthy cruises, a full and efficient complement of men must be carried. As an approximate rule, perhaps that of one hand to every ten tons, inclusive of the sailing-master, mate, or pilot, and cook or steward, may not be far out for home cruising; and exclusive of these when longer voyages are contemplated. This rule will hold good up to 70 or 80 tons, but above that the number may be diminished as the tonnage increases. Yawls and schooners are much easier to be handled than cutters, the sails being more distributed, not being so large and heavy to handle as cutters, and consequently a less number of men will be required to manage them. Cutters, therefore, are not adapted for foreign cruising from their heavy rig; and for this reason schooners or yawls must be preferred. Many cutters have a double rig—that of cutter and yawl, so as to adapt them for home cruising and racing, or by removing the boom and large mainsail, and rigging them with a mizen and lug, and a much smaller mainsail, thus adapt them for the heavier weather they cannot escape during long cruises.

With respect to the wages of men, there is considerable latitude: capital seamen may be had at 20s. per week, and excellent hands—stout growing boys at 15s. A sailing-master, of average ability, at from 25s. to 30s. per week; a mate at 23s. to 25s.; and a cook and steward, where both duties are combined, at from 20s. to 23s. When it comes, however, to picking an A1 crew, the wages increase in proportion to the experience and standing of the men: a sailing-master may be set down at from £100 to £150 per annum; mate at 25s. to 30s. per week, and men from 21s. to 28s.; all hands finding themselves in provisions, but it is usual to find them with clothes. For long cruises the arrangements may have to be made differently as to wages and provisions; in such cases the proper victualling of the crew must be provided for, as if left to themselves very awkward contingencies may arise.

It is advisable for yachtsmen to provide themselves with the Acts of Parliament relative to seamen, and make themselves acquainted with the sections thereof, having reference to a bearing upon the engagement of seamen in yachts. They will thus be enabled to provide against or deal with any difficulties that may arise, and as there are not a few sea-lawyers to be met with amongst the pleasure navy Jacks, it is highly necessary to be enabled to deal promptly with such characters, as men of that description will, if unchecked, set a whole crew by the ears, but when met with decision and energy on their own grounds of argument or opposition are easily vanquished. I should recommend every yachtsman desirous of having a well-regulated ship under him, when engaging a crew at the commencement of the season, either for home or foreign cruising, to have a proper and legally-authorised agreement drawn up and signed by both parties, whereby both employer and employed will clearly understand the nature of their obligations to each other. It may also much simplify such business matters as may be connected with the Customs or Board of Trade regulations, if owners of yachts take the precaution of having their own names inserted in all necessary papers or forms that may be required, as captains and masters of their own vessels, instead of those of their sailing-masters; as in case of the discharge of the latter, hitches of a "red-tape" nature may occur in official departments, which, although trivial in themselves, often lead to vexatious delays and unnecessary trouble. Four Acts of Parliament legislated in recent years upon the obligations between seamen and their masters—namely, 5 & 6 William IV., cap. 19, passed in 1835. This

Act was amended by that of 7 and 8 Victoria, cap. 112, entitled the "General Mercantile Seamen's Act." Another amendment appeared in the 8 & 9 Victoria, cap. 116, entitled the "Seamen's Protection Act," and finally we have 13 & 14 Victoria, cap. 93, passed and commonly cited as the "Mercantile Marine Act, 1850."

It has long been a proverb, that there never was an Act of Parliament through which an astute legal Jehu could not drive a coach and four, and certainly so far as yachtsmen are interested, a very considerable latitude has been allowed in those which concern their pursuits. However, this is as it should be, for a body of gentlemen whose favourite occupation of their leisure hours tends so greatly to the benefit of our maritime reputation, are not likely to require much legislation on their behalf. The principal point, however, that concerns yachtsmen is the relation in which they stand with regard to their crews: sailor Jacks have their vagaries and weaknesses the same as other classes of Her Majesty's subjects, and require occasionally the fore-finger of the law to be held up to them admonishingly. Yachts, no matter what may be their tonnage, are exempt from those written agreements of engagements with their crews, which are compulsory on other classes of vessels not immediately coming under the designation of the Royal Naval Marine. It would be very satisfactory if some yachtsman of experience in the House were to bring in a short bill containing in a few sections the necessary laws for the government of the yacht fleet, more particularly as regards the engagements with the sailing-masters, mates, pilots, and seamen; and touching upon such matters as collisions, running down, privileges in home-ports, pilot dues, port dues, &c.

Under the existing state of the law, however, yachtsmen must look out for themselves, and by conforming strictly to the present Acts of Parliaments, protect themselves from inconveniences that are by no means of unfrequent occurrence. As I have said before, it will be found most satisfactory, notwithstanding that they are not required to do so, for yacht-owners to have written agreements with their crews, care being exercised in drawing them up that the strict letter of the existing law is complied with. Formerly seamen were obliged to produce and deliver into the hands of owners or masters, register tickets to be held as security for their good conduct during the period of service; but by 13 & 14 Victoria, cap. 93, sec. 32, the Board of Trade, now vested with supreme authority in those matters, have dispensed with these

register tickets; it therefore doubly behoves yachtsmen, deprived thus of this security to protect themselves by an agreement, and by sec. 46 of the same act, the following is the nature of agreement prescribed:—

"And be it enacted, That every master of a ship shall, on carrying any seamen to sea as one of the crew, enter into an agreement with him in the manner hereinafter mentioned; and every such agreement shall be in a form to be sanctioned and issued by the Board of Trade, and shall be dated at the time of the first signature thereof, and shall be signed by the master before any seaman signs same, and they shall contain the following particulars as terms thereof:—

"1.—The nature, and, as far as practicable, the length of the voyage, or engagement on which the ship is to be employed.

"2.—The time at which each seaman is to be on board, or to begin work.

"3.—The capacity in which each seaman is to serve.

"4.—The amount of wages which each seaman is to receive.

"5.—The scale of provisions which are to be furnished to each seaman.

"6.—Any regulations as to conduct on boord, and as to fines, short allowance of provisions, or other lawful punishments for misconduct, which have been sanctioned by the Board of Trade, as proper to be adopted, and which the parties agree to adopt.

"And shall be so framed as to admit of stipulations, to be adopted at the will of the master and seaman in each case, as to advance and allotment of wages; and may contain any other stipulations which are not contrary to law.—See 13 & 14 Victoria, cap. 93, sec. 46.

According to such a form, any regulations relating to pay and provisions may be introduced, as also such as shall govern the proper discipline of the yacht. In case of a yacht going foreign, such agreements may be made before a shipping-master, and must be in duplicate—one to be retained by the shipping-master, and the other by the owner. For home-cruising yachts the intervention of a shipping-master is not requisite to add weight to the document, but it may be made on board, read and explained to the crew, and signed by them in the presence of a witness, who shall attest the same by his signature.—See 13 & 14 Victoria, cap. 93, sec. 47-48.

Furthermore it will conduce to the maintenance of a good understand-

ing, if the following section is complied with:—"That the master or owner shall, at the commencement of every voyage or engagement, cause a legible copy of the agreement (omitting the signatures) to be placed on board in such a manner as to be accessible to the crew."—See 13 & 14 Victoria, cap. 23, sec. 54.

Desertion from a ship, refusal to join, or being absent without leave, is provided for, as also false statements as regards ship last employed in, or name, by the signature of such an agreement.—See 13 & 14, Victoria, cap. 93, secs, 70, 71, 72, 73, & 75.

Any master, mate, or seaman, who, by breach or neglect of duty, drunkenness, &c., may endanger the vessel, or life, or limb, or refuses or omits to do any lawful act for preserving the vessel from damage or destruction, shall for every such offence be deemed guilty of a misdemeanor.—See 13 & 14 Victoria, cap 93, sec. 77.

Any seaman guilty of the following offences, on proof of the same, and due entry in the Log Book, may be punished by imprisonment, with or without hard labour, upon the arrival of the vessel at any port where there is a court of justice capable of exercising summary jurisdiction under the Act.

"1.—Twelve weeks for wilfully damaging the ship, or embezzling or wilfully damaging any of her stores.

"2.—Twelve weeks for assaulting any master or mate.

"3.—Four weeks for wilful disobedience to any lawful command.

"4.—Twelve weeks for continued wilful disobedience to lawful commands, or for continued wilful neglect of duty.

"5.—Twelve weeks for combining with any other, or others of her crew, to disobey lawful commands, or to neglect duty, or to impede the navigation of the ship, or the progress of the voyage."—See 13 & 14 Victoria, cap. 93, sec. 78.

There is no department of a yacht's routine that a yachtsman should be more particular about than the proper and regular keeping of a log book, being, in fact, the official record of every proceeding on board, that at any time may require to be substantiated. The Board of Trade sanctions official log books, in which, in addition to the ordinary ship's log, entries of all such matters as the conduct of the crew, illness, accidents, or death, of seamen leaving the ship, &c., and no entry shall be made in the log more than twenty-four hours after the vessel's arrival in port.—See 13 & 14 Victoria, cap. 93, secs. 85, 86 & 87.

Owners of yachts proceeding on foreign voyages will observe that they must have, and keep constantly on board, a sufficient supply of medicines and mendicaments suitable to accidents and diseases arising on sea voyages; and every ship (except those bound to European ports, or to ports in the Mediterranean Sea, or in Her Majesty's dominions in North America) shall also have on board a sufficient quantity of lime or lemon juice, sugar, and vinegar, to be served out to the crew whenever they shall have been consuming salt provisions for ten days. Penalty for not keeping medicines and lime juice, vinegar, &c., on board, £20; and for not serving out the latter as prescribed by the Act, £5 for each offence. Should any master, mate, or seaman receive any hurt or injury in the service of the ship, he shall receive all medical and surgical attendance, medicines, and subsistence until he shall have been cured, or conveyed back to some port in the United Kingdom, at the expense of the owner of the ship. Every ship, the voyage of which shall be deemed to exceed twelve weeks, having fifty persons or upwards on board, must carry as one of her complement some person duly authorised by law to practise in this kingdom as a physician, surgeon, or apothecary. Penalty in case of default not to exceed £100.—See 7 & 8 Victoria, cap. 112, sec. 18, and 13 & 14 Victoria, cap. 93, secs. 64 & 65.

The masters or owners of yachts proceeding on foreign voyages must transmit to the collector or comptroller of the customs at their port of departure a list of their crews; and upon their arrival home at their final port of destination; a similar list must be delivered within forty-eight hours. Yachts on the home stations must deliver, or transmit to the same authorities, lists of their crews within twenty-one days after the 30th of June and 31st December in each year.—See 7 & 8 Victoria, cap. 112, secs, 26, 27, & 30.

The act passed in the session of 1862, 25-26 Victoria c. 63, the Merchant Shipping Act, 17-18 Victoria cap. 103, is extended to sea-going yachts, the provisions of which are very stringent and sweeping, and therefore should not be overlooked.

The necessary forms for agreements, lists, returns, and log books, under the Act, are authorised by the Board of Trade, and must have the engraved seal of the Board upon them. The forms, &c., can be obtained at the shipping offices; the penalty for using any other form being £10.

In drawing attention to such sections of the Acts of Parliament a

secure protection to a yachtsman in dealing with refractory members of his crew, I must not be understood as desirous of conveying the impression that difficulties with them are of such frequent occurrence as to require constant recourse to the law upon these subjects. As a general rule yachts' crews are well conducted, and if they see their interests and wants looked after and attended to, and that they are made comfortable on board by that observance of even trifling minutiæ, which, though ever so trifling in themselves, are still conducive to comfort and indicative of thought and consideration on the part of the owner, they will feel bound to render good and faithful service, and be at all times obedient to command; but as there is no general rule without an exception, sometimes a sea-lawyer will turn up, or some cross-grained long-shore loafer may be engaged upon an emergency, when precepts and example will contribute much to disorganize an otherwise well-disciplined and well-intentioned crew. A man of this discription sometimes intimidates the sailing-master, who, averse to personal altercations if he be a quiet man, and preferring a peaceful forecastle, overlooks the delinquent, with a view of getting rid of him when opportunity presents; therefore, duties which should be performed by him are thrown upon the shoulders of others of the crew; and grumbling and discontent is sure to ensue, which is much increased by the triumphant manner of the malcontent, and the recommendations he freely indulges in to "do as he does, and never mind the —— hooker on her skipper!" If such a man should not discover himself until the cruise is advanced, and that the vessel is not in any locality where he can be replaced, the evil is multiplied; but to let such go unpunished should not be tolerated. Yachtsmen are very often to be found of such an easy nature, and so averse to giving themselves trouble, or allowing any noisy altercations on board, that in nine cases out of ten such a fellow, or any number of them, escape scot free; but is this fair to others? There is a great laxity of discipline under this head that should not be permitted to exist. Lists are supposed to be kept at the different club-houses of seamen employed on board the yachts belonging to the club; but how can the officials, charged with the keeping of such lists, do so properly, unless they are furnished by the yacht-owners with the particulars of such delinquencies? And then suppose a list be accurately kept at one club house, and the black mark attached to a man's name for misconduct, why all he has got to do is ship on board a yacht belonging to some

other club where his name may not appear at all, and there exists no information as to his short-comings. There should be a list of seamen generally employed in yachts compiled, and a copy furnished to every club-house; and every yachtsman should make it his duty to mark off defaulters, or forward such information as will enable them to do so; but what is everybody's business is nobody's, and until a general code of rules is established for the regulation of yachts and yachtsmen, their crews, and the club-house lists, we must despair of anything like co-operation and consequently perfection of arrangement.

I have known instances where hands have left yachts without any notice being given to the owners thereof, taking their clothes with them, and shipping on board of other yachts merely because they were promised three or four weeks' additional employment; and when representations were made, the sailing-masters of these yachts only shrugged their shoulders, and stated that they would represent the matter to their owners; but taking precious good care at the same time that they did not do anything of the kind. Now these were really good, well-conducted men in other respects, and prime seamen; and depending on the promised redress, further steps were not immediately taken, the men being still retained in their new employments. Eventually they were "black marked" on the club lists. Yet these very men were employed the ensuing season on board vessels belonging to the self-same clubs, showing that yachtsmen themselves are somewhat to blame in thus passing over such misconduct, and thereby leaving themselves open to a repetition of the same annoyances. Instances such as these should be punished at once, and the offenders made such an example of as to deter others from doing the same.

Often, too, considerable annoyance and inconvenience is experienced by the neglect of crews in dry harbours, by not properly attending to their vessels on the rise and fall of the tide, and many a yachtsman, upon returning from an inland excursion, has perhaps found his vessel upon her beam ends in the mud, the sailing-master and mate away on some pretext of duty; but if the truth be told, on pleasure bound, leaving the poor little ship to the care of some boy—for on the principle of "when the cat's away the mice may play," the crew in such cases follow the example of their superiors, and think they are entitled to a little relaxation also. Now what can be more provoking to a yachtsman than this, particularly if he is only a beginner? It is quite enough to

cause such disgust as will induce him to give up yachting altogether; yet it may be traced to a listlessness or want of energy in promptly visiting such neglect with whatever punishment maritime law permits to be inflicted. As to dismissing the whole crew at once and replacing them by other men on the spot, it has but poor effect: it is but a week or so of loss of work, and the same men will perhaps be found in the very first yacht that may be met with, as impudent, as devil-may-care, and as jolly as if nothing wrong could be imputed to them; rather looking upon the matter in the light that a school-boy would regard some past escapade, than as an offence worthy of serious punishment.

Although perfection in a crew is difficult of attainment, yet a good deal depends upon a yachtsman himself in the way in which his crew are treated. I look upon economy in the matter of wages to be faulty; really good men cannot be expected to serve willingly and cheerfully when they know they are not receiving a full equivalent for their services. Excellent men, no doubt, will be obtained at low wages, so far as pulling or hauling is concerned; but this does not constitute all that is required of them: it is the steady observance of routine duty, the ever-watchful alertness to keep everything neat, clean, and in its proper place, the determination to make duty go along smoothly and well, that quiet, orderly system that is not affected by sudden fluctuations, the absence of noise and confusion that indicates a crew of good, steady men—these are the qualifications that must be sought for in addition to daring, hardihood, and contempt of danger. It is not difficult to obtain individuals possessed of these latter qualifications, but wanting in the others: they prove capitail hands during a race where all is excitement and novelty, this excitement dies away—there is constant craving for more —they become irregular, and require much looking after; whereas the steady, thorough good sailor takes everything in the way of duty, whether it be a stirring race, a stormy cruise, or polishing up and improving his craft whilst lying quietly at anchor. He has an eye after everything at all times, and does not require to be constantly reminded that a rope wants whipping here, or a block mousing there, that a seizing is slack, or the copper would be better for a polish, or that chafings along the bulwarks can be easily repaired by a brush of paint; and as to halliards hanging in bights, or straggling uncoiled about the deck, or the boats being untidy and dirty looking, or the deck anything but snow-white, such things he would regard with horror; a slovenly furl of a sail would

drive him beside himself, and as to being untidy or neglectful of his person that never enters his mind under any circumstances of wind or weather. I would much prefer handling a vessel with a short able crew, and I believe they would rather do it themselves, knowing the dependence they could place upon each other, than have a full complement of hands of an inferior description at less wages. The first expense is the best, and ensures the greatest amount of pleasure and comfort.

In my previous chapter I mention the great advantage of securing a good sailing-master; such an one will have considerable influence on the conduct of a crew of even an inferior description; but as good seamen like to consort with their own class, perfection of discipline need not be expected, so I would suggest to the young yachtsman to begin at the fountain head, and secure first-rate men, from the skipper to the cabin boy, if he carries one, and much annoyance and considerable additional expense will be saved, whilst the order and regularity that will reign on board his vessel, and the style in which work will be carried on, will stamp him at once amongst his brother yachtsmen as one that knows the difference between right and wrong—between a Thames barge and a Solent clipper, not but that I have seen Solent clippers anything than what they ought to have been, but then we often see the yellow clay break out through the Plaster of Paris.

## CHAPTER XXX.

"'And now the land,' said Othere,
'Bent southward suddenly,
And I followed the curving shore,
And ever southward bore
Into a nameless sea.'"—LONGFELLOW.

WHEN a yacht is launched and all ready for sea, a yachtsman should resolutely go to work to make himself a good working hand in the first instance, watching closely and making himself perfectly acquainted with the way in which things should be done; if he has had the advantage of owning a small craft previously matters will come very easy to him in a short time—a vessel of five or six tons is an excellent preparatory school; but then the handling of a large vessel is at first apparently somewhat different, the cause being the much heavier gear, spars, and sails that have to be worked, and which require somewhat more of professional skill, than the pack threads, walking-sticks, and pocket handkerchiefs by means of which a mosquito creeper is urged along; not that I mean to disparage little craft of this description—on the contrary, I have a great respect for them, and passed many a pleasant cruise in them; but comparatively speaking, such is the relation their gear bears to that of a fine slashing fifty or sixty ton racer.

Many, I have no doubt, may laugh at the idea of any man wealthy enough to keep a large yacht taking so much trouble when he can get all these things done for him, and perhaps think they were lowering themselves by tailing on to the same end of a rope as a fore-mast Jack; but as I presume to offer my lucubrations only to those who wish to become thorough good practical yachtsmen and seamen, and not mere passengers on board their vessels, I can only say, there is no Royal road for becoming proficient in this no more than any other active pursuit that a man wishes to excel in; he must work with his own hands and see with his own eyes, and when he knows how a thing ought to be done he will have perfect confidence when giving orders to others.

As to any unpleasant position that a thirst for nautical information

may lead to, by undue familiarity with a crew, in mixing with and working amongst them, I do not think any such thing likely of occurrence, at least if it did the fault would probably be on the side of the master, not of the men; Jack knows his place too well for that, and it is only unbridled licence, or gross vulgarity, that will at any time tempt him to forget the respect he ought to pay, or the difference of position between him and his master; on the contrary, sailors like and respect a man more that knows or seeks to make himself acquainted thoroughly with the working of a vessel, and will obey orders with much more alacrity and confidence when given by one whom they know understands whether they are properly carried out or not.

We all know the compassionate feeling with which seamen in the royal service regard officers whose wealth or family interest has enabled them to obtain commands which they are well known to be unfitted for; in certain cases pity is more nearly akin to scorn than to the tiny god of bows and arrows. Who has not been amused at Marryatt's description of the noble lord whose nautical abilities were confined to the idea that the weather main-brace always wanted tautening, and that the best way to clear a foul fore-topsail halliard was to cut the topsail tie? Nothing can enhance the pleasure of yachting so much as to be enabled to take charge of one's own ship at times, without any danger of appearing ridiculous in the eyes of the crew, or giving a cynical "friend" an opportunity of framing an amusing story for a dinner table. In Navigation, the use of charts, taking an observation, and such matters as superior education can be brought to bear upon, the yachtsman will find his least difficulty; for all practical purposes a very little study and application will enable him to master quite sufficient knowledge, under these heads and encouraged by the application of this knowledge, he will gradually and almost insensibly acquire those more abstruse branches that will entitle him to take rank as an accomplished navigator. The study of, and making himself acquainted with the prognostics of the weather will take time, and this is a very important study that should by no means be neglected or carelessly treated; in this the barometer will prove an invaluable guide, by closely watching the fluctuation of this, the sailor's best friend, and keeping a careful daily register, noting the results of the rising and falling of the mercury, it will prove an instructor unfailing and infallible, and such an one as will in course of time enable the observer to form most accurate conceptions of the probable weather

that may be anticipated. Natural phenomena, such as the movements of clouds, birds, appearance of the sky, steady or variable winds should by no means be neglected, as taken into consideration with the fluctuations of the mercury they will form such valuable auxiliaries to weather prophecy, as in reasonable course of time will enable any one of even moderately retentive memory, by continuous observation almost to read the sky as he would a book, it is the great book of Nature and well repays the study of it, and a yachtsman should make it a habit never to come upon or leave the deck without casting a searching glance around and connecting in his mind the indications noticed with the then state of the barometer, bringing memory to aid him by comparing the results of similar indications noted upon previous occasions. Those who have not made the weather a subject of study may smile at the labours of the late Admiral Fitzroy, and perhaps indulge in not very sensible pleasantry at his so-called assumption of the duties of "clerk of the weather office," but the gallant veteran could well afford such sceptics the liberty of joking at him, he was right and he knew it too well to be lightly turned aside from the good work he had entered upon by idle ridicule; some years hence the mass of facts he was engaged in collecting and reducing into form, will be hailed with wonder and delight, and incredulity will give place to steady belief.

As I have said, superior education will give the master advantages over the man on all subjects connected with navigation, but where the latter will have the superiority is in what may be called the mechanical part of a sailor's training, a superiority which a long and weary apprenticeship entitles him to, but which a little energy, determination, and perseverance, aided by quickness of apprehension, will very speedily enable a yachtsman amateur sailor to achieve. An A.B. in the majority of cases learns the manual part of his profession mechanically; he does not bring reflection to assist him, so as by investigation of the reasons for performing certain operations, the results thereof may upon the moment fix the *modus operandi* in his mind. It is by repeatedly performing the same thing over and over again that he acquires the skill and dexterity which becomes a habit, that enables him to make a knot, splice a rope, reeve a gear, bend, shift or shorten canvas, and perform such duties as are required to work a ship, almost with eyes shut, and certainly upon such nights of darkness as render eyesight of but little avail; all he requires is to lay his hand upon any rope, spar, or sail,

and the nature of the command given at once acquaints him that a thing he has done perhaps thousands of times previously requires to be done over again, and accordingly the machine goes to work with accuracy and expedition. I do not say that an amateur sailor can at once acquire that deftness of hand which enables the professional seaman to display such lightning-like rapidity and neatness of finish that proclaims long practice and complete skill; but I have no hesitation in saying that the habits of observation and practice of contrasting cause and effect induced by education, will enable him to learn how any particular work, or duty connected with any evolution about to be performed, should be done, and that, once acquired, skilful manipulation becomes a matter of practice and is tolerably certain to follow. Therefore, I would say to a yachtsman ambitious of becoming a sailor not only in theory but practice, go to work steadily the moment your ship is afloat, and not too violently or enthusiastically either, but gradually and perseveringly, learning day by day, and bit by bit, everything that is necessary a sailor should know. Do not attempt too much at once, accomplish a single knot to begin, but learn how to do it thoroughly, so that in a moment of emergency no doubt may perplex as to whether it is properly done or not; do not rush eagerly from one thing to another, but never leave any one thing until you are satisfied you understand how to do it, by the feel even without looking, and you know when and where to apply the knowledge of its utility. It is this facility of doing things by the touch that constitutes the perfection of a smart and skilful sailor, for whilst his hands are rapidly performing the duty, his eyes are eagerly scanning its effect, or on the look-out for any object that may challenge attention; of course there are many operations that require eyes and hands combined, but I speak of the general work that is involved in the handling of a vessel.

Above all things that a yachtsman most requires to exercise his determination upon is that of overcoming that false pride, or perhaps to give it a more gentle term, delicacy, which prevents him asking for information; there are many such slaves to this fear of being thought ignorant by simple and uneducated men, that it becomes a perfect mania with them, and like other well-meaning people inhabiting this planet of ours, who from the constant repetition of incredible stories at last cheat themselves into the belief that they are true, also make themselves and others believe that they are perfectly well-acquainted with manual operations that they know as much of squaring the circle as the philosopher's stone.

A yachtsman should never have the least hesitation in asking a question as to the manner of performing any duty, even to the smallest boy on board; he is not expected to know how to do it, and his men will not only be pleased, but flattered at having something worthy of their master's knowing to show him, and will take no little pride in instructing him correctly; he loses nothing whatsoever in their estimation: on the contrary, Jack will feel that his owner is, and ought to be, a sailor; and that the more he knows and that they are enabled to teach him, the better will their interest be looked after, and the good men distinguished from indifferent loafers.

Yacht sailors generally take no small pride in their "gentleman" if he distinguishes himself in nautical skill and information, and many an amusing conversation could I quote between rival crews as to the claims of their respective owners to the title of a "reglar salt;"—there is not perhaps a class of men who entertain a more hearty contempt for pretension to nautical knowledge amongst their superiors than yachting Jacks; they may smile and agree with rhodomontade yarns which a well got up amateur Columbus may entertain them with in his visit on board a friend's yacht; gales of wind, lying-to under balance reefed trysails, wonderful passages, and cups won in the teeth of a storm, are reckoned up and weighed to a nicety, and the corn is separated from the chaff in a manner that would "rather" astonish the valiant narrator if he could render himself invisible for a few minutes when the forecastle pipe is going its rounds on the heel of the bowsprit. "Any baccy, Tom?" "No, Bill Bo—all blew out o' my box in the squall that there gentleman lost his conscience in;" "Don't be spiteful, Tom; it was no worse than your shark bein' blown into the maintop!"

A foremast hand will recognise at once the moment a visitor steps into the gig whether there is anything of blue water about him, the way he handles the yoke lines, the orders "In bow!"—"Oars!"—simple in themselves, have a talismanic effect, and it is wonderful what a difference it makes.

Of course a good deal depends upon the time a yachtsman is enabled to devote to cruising; if he is independent of the grim old gentleman with the scythe, he can proportion his amount of self-imposed work as suits him; but if, as many are situated, the pursuits of business or professional avocations prevent so much time being devoted, except at intervals, it will prove instead of work a healthy and invigorating source

of amusement. To lay down any regular system, therefore, would be needless, everything depends so much upon an individual's own arrangements and habits. With a new vessel perhaps the novelty of a toy does not give more gratification to a schoolboy than to a man passionately fond of aquatic sport, but to enjoy that sport to perfection he should remember that launching a vessel off the stocks all a-taunto does not contribute her as fit as she may be rendered by a little self-denial at the first; very many start away at once even before the chips and shavings are got properly rid of, and I have known instances of yachtsmen taking whole gangs of painters and cabinet-makers away in a cruise with them so impatient were they to see their pet under canvas. It is just such impatience as this that very often spoils a vessel, by giving that occasion for a hurried fit out and careless finish that once indulged in is almost safe to distinguish future proceedings; there are many things that require some few days quiet work at moorings to complete properly, and that undue haste should not interfere with. I will even say that eight days or a fortnight might be spent at moorings with what benefit I shall endeavour to show. There is not any one point to which a yachtsman requires to pay more attention than in the stretching of his new sails, and the best way to accomplish this successfully is to do it at moorings. If a vessel is got under weigh, with new canvas just bent and set, the chances are ten to one that they are completely spoiled unless under very careful management. Now, if on the contrary, they are hoisted at moorings and allowed to blow and flap about without any weight of wind being allowed to press upon them, if they are well cut and proportioned sails the delay will amply repay; they will stretch gradually and evenly, seam sewing, roping, and canvas each to the extent designed, and thus that great perfection—flat standing canvas will be secured. The reason of this will be obvious, for the severe strains that must be brought to bear on new sails that have not been thus stretched previous to use, causes them to do so unequally, parts being wrenched and strained to make them sit flat before their time and consequently when the canvas and roping begin to give out in due time, not all the tackles or tacks in the world will take slack canvas thus induced out again, and which forms the unsightly and injurious bags or bellies to sails that render them almost useless. Whilst this stretching of the sails was taking place a yachtsman might make himself well acquainted with the following details: It will be presumed that as the vessel progressed in her rigging he had

carefully studied the fitting of both running and standing gear, the parcelling, marling, serving and seizing operations; splicing in blocks, the manner in which the peak, main, fore, jib and topsail halliards were fitted and rove; how the main sheet, jib, fore, and topsail sheets were fitted and rove; how the topmast shrouds, signal halliards, heel rope of the topmast, fid, &c., were fitted and worked; and the bowsprit standing and running gear should likewise receive minute attention. It is particularly worthy of note, that simple as the reeving of any part of the running gear may appear to be when in its place; yet to unreeve it and then replace it again becomes a little puzzling; unreeving and reeving therefore should be practiced with both main and peak halliards; with the runner falls, the bowsprit shroud tackles, the main sheet, the jib halliards and topsail halliards, the topsail sheet, &c. Once the yachtsman has mastered these a very important knowledge is gained at the outset. Now an apparently very simple operation is that of belaying a rope on a cleat, pin-rack, or timber head, and yet this may well form the subject of an entire lesson to be well studied and practised, for a slippery turn of a rope, so carelessly or imperfectly done as to cause it to render or give up, might at times involve serious consequences. To adduce, however, a similar instance, there is nothing requires more attentive looking after than the jib, if the halliards are of hemp or Manilla instead of galvanized chain, they stretch and give up more or less, and the luff of the jib becomes as it is termed, all in a bight; this must be remedied by a pull on the jib-purchase, for unless the jib has a taut luff when a vessel is close hauled it might as well be off the bowsprit altogether. Now it takes a good steady sea drag of all hands to set up the jib with full way on the vessel, or otherwise it involves her being luffed up in the wind, and the jib kept shaking. Nothing can be more annoying than when this operation has been completed to find that by the fall being belayed in a careless or insufficient manner away flies up the purchase tackle again, and the jib has to be set up anew; more serious would it be with the main or peak halliards, when the mainsail might come down by the run at a time when all its benefit was required to keep the vessel up to windward, perhaps in beating off a lee shore, or what would be excessively awkward indeed—when beating through a crowded anchorage.

There are sundry other matters connected with the rigging and gear, such as bending two ropes' ends together, forming running and standing

bowline knots, bending a rope on a spar, making fast a hawser or hauling line to a ring, splicing, &c., to which I have referred in detail in former chapters, and which can be made to occupy the time profitably whilst the new sails are getting fair play. It is during this time that excellent practice can be had in bending, shifting, and making sail, and I question much if for this purpose alone the time would not be well devoted. There is no branch of yachting that yachtsmen are more deficient in than the handling of sails; so therefore at this particular time the bending of the mainsail, seizing it to the mast hoops, reeving, hauling out and making fast the head and clew earing, bolting the throat or nock, and all the operations in handling this important sail can be well studied and practised; then seizing the foresail to the hanks on the stay, setting, shifting, and taking in a jib, setting and shifting topsail, getting the latter from the lee to the weather side, and bending and setting storm canvas, will not only make a yachtsman conversant with all that is important for him to become practically acquainted with, but at the same time new gear and sails will be brought into admirable working order, and by the time everything is properly ready for going to sea the yachtsman will be enabled to do so with perfect confidence in himself and his vessel.

## CHAPTER XXXI.

" Then towered the mast, the canvas swelled on high,
And waving streamers floated in the sky;
Thus the fine vessel moves in trim array,
Like some fair virgin on her bridal day;
Thus like a swan she cleaves the watery plain,
The pride and wonder of the British main."—FALCONER.

IN PREPARING to get under way, there are many little details necessary, the observance of which tends in no slight degree to the maintenance of that order and discipline which should ever be observed on board a yacht; nothing can be more lubberly or unseamanlike than the appearance of a vessel getting away from her anchorage or moorings with everything about her decks in disorder, denoting unseemly haste, and an anxiety to get the canvas upon her in any fashion; the running gear falls all in confusion, sail covers thrown about here and there, oars and boat-hooks in everybody's way, mops, swabs, and brooms jammed in amongst the halliard falls, buckets and fenders tripping up the crew in every direction; in fact, as Jack will observe of such a craft, " She is like a hurrah's nest, or a billyboy caught in an Irishman's hurricane!" If such a managed vessel is getting away from a crowded anchorage, and it is blowing fresh, the chances are ten to one if she does not get into an awkward scrape; even if it is not blowing hard, but a moderate working breeze, it may be requisite to execute some manœuvre quickly to prevent her getting foul of some other vessel, and then in the hurry of the moment nobody knows where to lay hands upon anything, or prehaps the wrong halliards are let go, and up flies the fall to the masthead, in beautiful entanglement with half-a-dozen other falls or sheets; then comes confusion worse confounded, and the loss of the bowsprit or some of its gear, the carrying away of the topmast, or of the cross-trees, is very likely to ensue, resulting in very ugly language, and much angry contention, to say nothing of the opinion left upon the minds of spectators as to the manner in which such a yacht is handled.

An experienced yachtsman will always guard against such a *contre-*

*temps*, and consider it a reflection not only upon his crew but himself to permit even a single rope to be astray before his vessel is in motion. The young yachtsman ought therefore to be most particular, should he perceive any disposition on the part of his sailing-master, or any of his crew to leave their preparations half completed, and should never allow his anchor to quit the ground, or the mooring bridle to be cast off the bitts, until everything necessary for a start is in perfect order,—such articles or spare gear as may not be required in working the vessel stowed carefully away, and when doing so, to observe at the same time that they are placed in certain positions allocated to them, that no time and labour may be wasted seeking for them when again required. Order and regularity is the great secret of comfort on board a yacht, a place for everything and everything in its place, if strictly observed, will make work go on with pleasure and regularity, and obviate unseemly haste that if permitted even in small matters at the commencement, will too soon become a standing rule.

I shall therefore call attention to such points as I conceive yachtsmen should be strict about, and by observing that they are fully attended to at the outset, his crew will soon perceive that they have no easily satisfied master to deal with, and that although he may be a novice—yet he has a pretty correct notion of how things out to be done, and has the qualifications for becoming a smart sailor.

I shall now proceed in the order in which preparations may be made for getting under way:—the accommodation ladder should be unshipped together with the brass gangway stanchions, and the port slide placed in its berth, the side fenders taken in and stowed, the vessel hove short upon her anchor, and the chain cable run down into the chain lockers; should any mud be upon it, let a hand stand by with a broom or mop and wash it off outside before it comes through the hawse pipe. The main and peak halliards unhooked from their straps round the boom, and placed ready for hooking on to the straps on the gaff; the mainsail covers unlaced, taken off, neatly rolled up, and stowed away; the main and peak halliards hooked on to their respective straps on the gaff; then let the gaskets, or as they are sometimes called, the tyers, which confine the mainsail in its furl, be taken off, all except the one that goes round the peak end; these gaskets should be made up and fastened together with a round turn and a hitch, and stowed away, so that they

may be easily come at when wanted; they are very useful in many cases of emergency, where a short end of rope may be required hurriedly; if the topping-lifts are fitted so as to unhook and fit with a strap when the mainsail is coated, they should next be hooked to their respective eye-bolts in the boom, then overhaul the main-sheet, man the topping-lift falls, let a hand stand by the boom crutch to take it in and stow it away; top up the boom to the height at which it is designed to stand when the mainsail is set, then belaying the topping-lift falls, man the main and peak halliards, cast off the gasket that has been left confining the peak, and hoist away the mainsail, taking care as it goes up to enter the gaff between the topping-lifts; hoist on the throat or main-halliards best, as the mainsail will go up easier than if the peak is kept high, which throws all the weight of the sail down on the throat; set up the main-halliards first, until the jaws of the gaff are to their proper height, when carefully belay them; then hoist away on the peak-halliards, finishing the setting by the peak-purchase, and when the sail shows a wrinkle or two at the throat, the peak is high enough. "Enough the throat!" "Enough the peak—belay!" will give the men to understand when both are high enough and the sail set; the peak down-haul, gaff-topsail sheet, and throat down-haul or tack-tricing-line, should be carefully overhauled as the sail goes up; and care should be taken that their bights on deck do not get foul of the main cabin skylight flaps, as if they do, the latter may be jerked up and let fall with a violence that will smash the glass in them; they sometimes also get foul of the companion slide or binnacle, and cause a temporary delay, any of which accidents, however, a quick eye will prevent.

When the mainsail is set, let the main and peak halliard falls be coiled away neatly close to the main bitts, and the coils capsized so that the running part of the falls may be uppermost; this should never be overlooked, as in case it may be necessary to let the main or peak go by the run, if the coils were foul they would be carried aloft in a terrible mess, and perhaps jam against the mast-head blocks and prove a cause of accident; sometimes neat mahogany or oak moveable cradles are used to coil these falls into; they are when in use lashed to small eye-bolts in the deck just abaft of the main bitts, and are very convenient and useful, preventing the tack-tackles, or other gear about the mast, or spare spars, topsail yards, legs, or boat-hook staffs, &c., getting foul of these halliards; next haul in the main-sheet hand-taut, so that the

boom may not be flying backwards and forwards across the deck, and perhaps knock some one overboard; see that the peak down-haul, or as it is often styled the ensign-halliards, topsail-sheet, and tack-tricing-line are all clear, and in order for running, and that the two former are led well in and belayed close to the boom jaws; next set up the runner tackle-falls well taut, so as to prevent the masthead being taken forward when the foresail and jib are set up; then reeve a couple of reef pennants (if not already in their places), taking care that they are rubbed over with a little tallow to make them render freely through the bee blocks on the boom, should necessity arise for hauling down a reef or two in the mainsail; set up the topmast shrouds if the weather admits of a gaff-topsail being set; get up whatever topsail is suitable to the day, lay it along the deck-luff forward, get the yard along, enter the throat-earing first and make it fast, then enter the peak-earing—having rubbed it with tallow previously to make it render through the eye in the yard, haul the head of the sail as taut as a bar along the yard, lighting it along from the throat to the peak, and assisting the peak-earing as it is hove tout; the earing should be passed twice through the eye of the yard, and twice through the thimble of the sail, then up over the yard, and through the thimble again, so as to confine it to the yard, and prevent the seizing rendering back, the remainder of the earing being expended in round turns over the yard, so as to form a seizing to the standing part; next pass the lacing that confines the head of the sail to the yard well taut (in large topsails knittles of spun-yarn are found more convenient and better than lacing, as if the lacing stretches, or chafes and bursts, the entire head of the sail gets adrift from the yard, whereas the knittles being independent of each other, neither mishap can occur), bend on the topsail-tye, topsail-sheet, and topsail-tack, take care that the tack-hook or clip is moused, so as to prevent it getting adrift; the topsail clew-line will be rove through a small tail block, bend on this tail block foreside of the topsail tie on the yard; sometimes the standing part is bent to the sheet cringle through the thimble, but by far the best plan is to have a smaller and separate thimble cringled on the leach of the sail above the sheet cringle, and in such a position as to bring the leach in fair up and down with the yard, the cringle exactly opposite to the clew-line tail-block: then having bent on the tail-block as before, reeve the standing part of the clew-line through this leach thimble, lead it up on the other side of the sail to the yard, where make

fast the standing part; by this method of bending a clew-line it becomes a brail to the sail, and confines it when clewed up snugly to the yard, instead of leaving the belly of it flapping and blowing about, shaking everything aloft; next take a piece of sail twine, and with a single turn and overhand knot confine the topsail tie to the peak end of the yard, which will enable the sail to be sent up, with the yard up and down with the mast, and when it reaches the topmast sheave the sail twine will burst, the fore part of the yard being then clear of the cross-trees; let a hand go aloft to the cross-trees, sway away upon the topsail halliards, taking care at the same time to steady out the topsail-sheet, and to keep the yard and sail fair as it goes aloft, by means of the tack fall; hook on the topsail tack-tackle; as the yard clears the masthead, let the man aloft pass the luff lacing of the topsail slackly round the topmast, when the yard is chock-a-block, man the tack-tackle and bowse the tack well down, let the luff lacing be then hauled taut round the topmast and masthead, and made fast; then man the clew-line, brail up the topsail, and it will be all ready for sheeting home when the vessel gets under-way.

The topsail should never be sheeted home until the bobstay and bowsprit guys are set up, and the topmast stay rounded in so as to take the topmast head well forward, and so enable the topsail to be sheeted home, with plenty of room to spare for a fresh pull as the sail stretches; and to preserve a slight bend or spring forward in the topmast for the purpose of making the topsail stand well and flat when the vessel is close hauled; if this is not attended to, the topmast will hang aft over the vessel's heel, and the sail can never be got to stand, besides spoiling the trim of the canvas, and throwing the centre of effort of the topsail out of its proper place; should such an oversight perchance occur, the topsail sheet must at once be eased up, and the topmast head got forward by means of the topmast stay, to do which it may be necessary to get a tackle on the stay by means of a strop, whereas had it been attended to in the first instance, it could easily be round in by hand.

The topsail being all ready, next proceed to heave down the bobstay, easing up the bowsprit shroud falls, jib halliards, and topmast stay whilst doing so; having got the bowsprit down, heave well taut the shrouds, round in on the topmast stay, and get the jib along with the tack and head forward, hook the tack on the traveller of the bowsprit hook on the

jib halliards to the head, taking care there are no turns in them aloft, and overrunning the luff rope of the jib from the head to the tack to guard against turns in it; then toggle on the jib-sheets, taking care in doing so that the bight of them is outside the forestay, that they are rove in their proper scores, and clear of other gear, and that there is an overhand knot on each sheet end to prevent them flying out of the scores when the sail is flapping; then man the jib outhaul and halliards, hoisting on the latter just to lift the sail and prevent it getting into the water, until the traveller is hove out to its berth; when it is, let the outhaul fall be belayed securely on the bitts; hoist the halliards hand-taut and belay them, finishing the setting up of the jib by means of the jib purchase; then let the sheets remain loose and the sail flowing; get the foresail uncovered and cast loose, and ease up the fore tack-tackle, hook on the fore-halliard, and toggle on the fore-sheets, taking care that the standing block hooks are moused when in the deck eye-bolts, to prevent them getting adrift when beating to windward; a good look round should next be taken to see that everything not required for working the ship has been stowed away in their proper places, that all falls are properly coiled away and ready for running, sheets clear on deck, fenders, buckets, mops cleared away; that the burgee is chock up to the truck, and signal halliards clear on both sides; the ensign should be run up in a ball to the peak and not broken loose until the vessel is underway and the topsail sheeted home.

If the vessel is proceeding on a cruise, the boats may next be got in; if the vessel is not fitted with davits for her gig, the latter can be got in by means of the Burton purchase hooked into the bow ring bolt, and the standing part of either runner (whichever side of the deck it is desirable to carry her upon) hooked to a strap on the main top-transom end, with the tackle hooked in the after ring bolt; when hoisting her up the looms of a couple of oars, or two flat board fenders made for the purpose, should be placed over the yacht's side to prevent the lands of the boat's planking being injured, or the vessel's bulwarks torn or disfigured whilst hoisting her in; when the boat is a little over the rail, slew the stern in first—haul her aft and lower on deck, taking care that chocks are placed under her keel if she is to be carried upright; it is, however, far preferable and more secure when bound on a cruise to carry the boat's bottom aloft, as in case of falling in with heavy weather if the boats be carried upright, and a sea sweeps the deck, they will be

filled, and if not greatly injured a weight of water will be retained by them difficult to be got rid of, and dangerous to the vessel if she is not a large and powerful craft; when carried thus, chocks must be put under the boat's gunnels amidships to prevent them being strained, and a shoe under the stem to prevent it marking the deck. The dinghy may be got in on the opposite quarter by hand, lifting up her bow on the rail, and hauling her in board on even keel; one of the deck mats or a swab should be placed on the rail to prevent its being injured by her keel; it is a better plan, however, to have a roller frame or "save-all" made so as to slip over the rail with a scored roller, that will just take the boat's keel in the middle of it: this roller frame will also be found useful for getting the gig on board; the boats need not be lashed until the vessel is clear of the anchorage and harbour, in case it may be requisite to get one of them out in a hurry; but once clear they should be properly secured, and in doing so care taken that whether made fast with gripes or lashings, the fastenings are made in such a manner as can easily be cast off in case of a man getting overboard or other accident that may require a boat over the side with the utmost despatch; it is the custom to lash the oars, boat hooks, &c., along with the topsail yards, legs, and spare spars each side of the companion and skylight, but this should not be allowed; each boat on board should have oars, mast, sail, boat hook, stretchers, rudder and yoke, crutches or thowl pins, bailer, and though last not least "plug" in her, lashed and fixed in their places, so that there may not be any hurrying or looking about for them in time of emergency; these precautions are not usually taken from the immunity from accident which yachts seem to enjoy; no false sense of security, however, should prevent them being observed, as experience might, even once in a way, be too fatally purchased; two life-buoys (Carte's) should be on deck hung in beckets or thumb cleets inside the bulwarks on each quarter, and available at a second's notice; all these details being looked to, and any other that may strike an observant yachtsman, the good little ship is ready for a fair start; it should now be determined which hand to cant her upon so as to obtain a clear course if the anchorage be crowded.

I shall assume that all is clear, and that she is to be canted to port on the starboard; let the cat davit be shipped, and the anchor stopper got ready, ship the tiller, man the windlass, and heave her up to her anchor, taking care that a hand stands by on the weather bow with a

broom or mop as before, should the chain come up with mud upon it, so as to wash it clean and prevent the deck being covered with a mess that will dirty the foresail and jibs, should the former require reefing underway, or the latter shifting; if the bottom is of stiff mud, and that the anchor holds firmly, overhaul the mainsheet, trim aft the jib-sheet, sail her up and burst the anchor from its hold; when it is reported away, run up the foresail, keeping the weather sheet to windward if she does not pay off quick enough; or if it is wished to heave-to until the anchor is catted, fished, and stowed, which is the better plan, as if she gathers way quickly before this is done the anchor may get foul of her stem and bobstay by the pressure of the water against her bow as she rushes through it, and will cause delay and trouble; the anchor being got to rights and secured, let the jib and fore and main sheets be trimmed for sailing; ease away the clew-line and sheet home the gaff-topsail, taking the fall to the mast winch if necessary, break the ensign loose, then hook on the weather main tack-tackle, and board the main tack to windward: hook on the fore tack, ease the lee fore-sheet an inch or two, and board the tack of the foresail well down to the stem head; then re-trim the sheet; see that the tiller ropes are rove, that no ends of ropes hang over the side, that the tripping-line of the chain bobstay is here hand-taut and not flying in a bight, such little details, although trivial, if neglected, look very slovenly, when fairly underway the jib-purchase may require another pull, and as this will slack the topmast-stay, the latter should have a good pull taken upon it at the same time.

The above suggestions for getting underway are given supposing that a vessel does so close hauled; sometimes when getting underway with a fair wind a vessel may start under her jib and foresail, she will pay off quicker than if she had her after canvas set; with the wind moderate she may then set her mainsail and gaff-topsail as she goes; but if it blows fresh the mainsail should be set while she is head to wind, as much difficulty will be experienced in doing so afterwards, unless she is rounded to; the peak halliards may be eased away and the mainsail scandalized, so as to enable her to pay off before the wind.

I will make a few observations here with regard to methods of setting gaff-topsails and jibs; there are two very excellent and smart ways of doing so, that with a very little practice men will execute quite as

quickly, and indeed as regards the sail when aloft, quicker than by the ordinary way; to begin with the topsail—after it has been laced to the yard it should be neatly made up along the spar, care being taken to keep the sheet cringle on the outside; the clew-line should be hauled taut; then gaskets of sail twine at every two feet or so will keep the canvas secure in its close furl, and the yard and sail sent aloft with great ease and smartness; if a small sized sail the gaskets may be cut half through with a knife, but in a large sail the weight of it will be sufficient; when desirable to sheet it home, by a smart pull on the sheet, the gaskets can be burst and the sail falls loose, but it must be eased down gradually with the clew-line, which should be kept in hand, as otherwise by the sail flapping to-and-fro suddenly the sheet may take a round turn on the gaff end, when, should such occur, a hand must be sent aloft to clear it. A jib may be made up in the same way, taking care to keep the clew cringle and sheet toggle clear, and is a very excellent way of setting a jib in blowing weather; it may be got out on the bowsprit and set up at the same time, purchased, and left so until desirable to make sail, when a smart haul on the sheet will burst the stoppings and cast the sail loose.

Another very good plan of keeping a jib snug when set at moorings or anchor, is to hook the Burton into the clew cringle and bowse the clew of the sail taut along the luff. When the jib is hove out on the bowsprit, if any of the above methods are not adopted in preference to letting the sail flow and flap about, the halliards may be eased away and the sail stowed with a couple of stops or gaskets on the bowsprit, or if both the luff rope and foot of the sail are hauled well taut along the bowsprit, a single stop just outside of the stem will be sufficient. After being a few hours underway in a new vessel, a small pull may be required on the halliards all round, as the ropes will be stretching; this should be done gradually and easily, so as to let the rope take its own time, as if it is too roughly treated at first, it will be strained and perhaps the heart burst, when a sudden carry away may be the result; the sails also will require looking after, the main-tack, fore-tack, jib-purchase, peak-purchase, topsail-tack, and sheet; and if the mainsail is fitted with a traveller on the boom, it, too, will want a small pull out, which can be accomplished by hooking on the reef-tackle to the traveller fall; in fact, when underway, a vessel, either old or new, requires occasionally to be refreshed by a pull up all round, for

the halliards and sheets stretch with working more or less, and the sails falls into bags or wrinkles; and then the vessel becomes sluggish and heavy, just as a human being tires from labour and want of refreshment.

## CHAPTER XXXII.

"For other cares the master's mind employ,
Approaching perils all his hopes destroy,
In vain he spreads the graduated chart,
And bounds the distance by the rules of art."—FALCONER.

HAVING in my last chapter got fairly under weigh, I will presume that the yacht is bound on a cruise, and to the many incidents that may befal her during this cruise, and the adjuncts thereto, I shall venture some observations in the following chapters. As it is not my purpose to perpetrate a treatise on navigation in the face of the many able works that are extant upon that subject, I shall merely mention such as will enable the yachtsman to keep a log, together with the charts and instruments necessary to assist him in doing so. As a preliminary instructor in navigation there is a most excellent little book that was published by the late Mr. John Weale, of High Holborn, and which can be obtained from Mr. Hunt of the *Yachting Magazine* entitled the "Sailor's Sea Book;" this little work will teach the yachtsman how to keep the vessel's log and work it off, or in other words to keep the dead reckoning; there are many yacht skippers who are well versed in both the theory and practice of this; but there are a great many who can do it but very imperfectly, and some, I am sorry to say not a few, who know nothing at all about it: here it is therefore that the superior education and more cultivated intellect of a yachtsman will prove of vast superiority, and enable him to carry his vessel with certainty to the wished for port; his sailing master will have the pull on him doubtless so far as practical skill in handling the vessel goes; but even this only at the outset, for close observation, and some little attention to cause and effect, aided by the natural taste for acquiring such practical knowledge, will in a comparatively short time enable him creditably to handle his own vessel. The second part of the work will teach him to find the yacht's place by observation, that is, the latitude by a meridian altitude of the sun, and the longitude by means of the chronometer.

In connexion with this work it will be necessary to have on board

"Law's Tables," also published by Weale, and the "Nautical Almanac." The instruments necessary to have will be an ordinary, but at the same time a good case of mathematical instruments; a Gunter's scale, a pair of large parallel rulers, those patented by Captain Toynbee, are the very best, and should be the only ones ever seen on board a yacht; a large sized pair of common dividers, and an "Opisometer"; the latter little instrument is but very little known amongst yachtsmen, but for measuring distances on a chart, particularly curved lines, indentations of bays, courses round headlands or islands, it has not its equal and, in fact may be said to have superseded the common dividers. The charts requisite to have on board will of course greatly depend upon the cruises contemplated, but as a general stock the following will be found a fair general average:—Mercator's World; the whole coast of England general chart; whole coast of Scotland general chart; and whole coast of Ireland general chart; Isle of Wight, Thames, Plymouth Harbour, Cork Harbour, Dublin Bay, Liverpool Bay, Isle of Man, Belfast Lough, the Clyde, and East Cost of England, sectional charts of Yarmouth, Harwich and Lowestoft.

To these the yachtsman may add, as they will be very useful for reference, set aside when a cruise may be contemplated in those waters, the North Sea, Baltic, and Gulf of Finland; Mediterranean, coasts of France, Spain, and Portugal, and North Atlantic. With reference to the "Sailor's Sea Book" before mentioned, the first portion of it treating protractor, mariners' compass, the use of charts, sailing—confined to Mercator's sailing solved by construction, as being the most accurate in theory, and least liable to mistakes in the method of solving; method of keeping a day's work and the log, is all that a yachtsman need make himself thoroughly acquainted with at first; for all practical purposes of home cruising he will therefrom acquire sufficient knowledge to take his vessel from the Land's End to John o' Groat's House, or from Yarmouth Roads to the Arran Islands, and exhibit a log book afterwards that will be highly creditable and pass muster before the elder and learned brethren of the Trinity-board. He may make himself acquainted with the methods of finding the latitude by observations of the sun with the sextant, and longitude by the chronometer, as pastime during such cruises; but he will not find such knowledge of much practical utility until he comes to adventure Maderia, New York, Central America, or the Mediterranean.

In home cruising one is but for very few hours out of sight of land, and the conformation of the various coasts a yachtsman may be on, afford sufficient data for fixing the position of the vessel at any time by means of a cross bearing. If he wishes afterwards to make himself acquainted with the more abstruse branches of Navigation, he may consult the more extensive works of Norie and Raper; but as these are more calculated for the study of such as adopt the sea as a profession, the information conveyed in their pages tend at the first going off rather to perplex the learner, unless he avails himself of the assistance of a nautical instructor. It is for this reason that I advocate the "Sailor's Sea Book" in the commencement, as from the simplicity with which instruction is conveyed in its pages, the science of navigation is simplified in such a manner as to give the yachtsman confidence and self reliance, and to divest the study of much of the apparently mysterious technicalities with which the more elaborate style of purely professional works tend to invest it.

There has been a very excellent work also published by Weale, entitled "The Log of a Merchant Officer." In this book the yachtsman will find a variety of good practical hints, more especially as regards the keeping of a log and journal; nothing is more useful than an accurately kept log, not only for the purposes of reference upon future occasions, but as a record of events and reminiscences that will call up pleasing recollections of by-gone adventures on the wave, and afford amusement during many a winter's night, when a knot of yachtsmen are met together in club-room or study, and like briny Jacks in the forecastle delight to spin their yarns of experience on the sea. Nothing tends so much to complete a log journal as a knowledge of drawing, there are few of our yachtsmen who are not gifted with a knowledge of the use of the pencil, and no matter how slight it may be, a little perseverance and practice will produce results highly pleasing and encouraging to the tyro; so many varieties of scenery are presented to the yachtsman's eye, such vagaries of nature in the shape of rocks, islands, caverns, such picturesque coast scenery, such stirring incidents afloat, that a dash of a crow-quill, or a facile pencil, can perpetuate, that it seems a prostitution of intellect to neglect the cultivation of an art to which yachting affords so many and diversified opportunities. I know many yachtsmen whose log books are perfect curiosities in this way, and one in particular whose spirited water colour sketches of Scottish

coast and Loch scenery in storm and calm, command no mean prices at the London Exhibitions.

In the "Merchant Officer's Log Book," before alluded to, there is an admirable appendix containing many valuable instructions relative to sketching; and treating of the management and delineation of sky, land, and figure drawing, that I cannot too forcibly direct cruising yachtsmen's attention to it; it should form a companion volume to the "Sea Book," as enabling accurate sketches to be made wherewith to embellish the log journal.

It is necessary that particular attention should be paid to the position of the binnacle on board a yacht, as the slightest deviation of the compass may cause serious errors to occur in the navigation of the vessel, and cause faulty bearings to be taken of the land; no iron should be allowed to be within seven feet of it, or more if practical. Some vessels are fitted with iron tillers, these may be very well for steering during a race, when compass bearings are not always requisite, but when cruising a wooden tiller is always to be preferred.

I would particularly impress upon yachtsmen the advantage they will derive from making themselves perfect masters of chart work—"chart, lead, and look out;" is an aphorism that should always be remembered. No matter how often a man goes into a port something new may strike him, for it is seldom he may enter it under the same circumstances of wind and weather, and any striking difference should be noted, in the log. It is also very useful to note upon the chart itself any peculiarities in the appearance of ports or harbours, light-houses, buoys, &c. In the latter two instances particularly, changes occur from time to time that are essential to be noted. The Trinity Board, the Dublin Ballast Board, and the Board of Scottish Light Houses issue periodically notices of any changes of moment that occur in lights or buoys. To search in the columns of public journals for the notifications of such, so as to keep an accurate record of them, would perhaps prove rather a severe demand on a yachtsman's time or attention, but a note to the secretaries of those boards at the commencement of a season will procure a return of such changes as have actually taken place or are contemplated, so that notes or slips thereof may be made in, or on, or attached to the charts or sailing directions.

With regard to sailing directions I may say that in general they are singularly defective; in much that relates to coasting work; therefore

my observations as to yachtsmen making notes will be found of practical value in this respect; after a few cruises it will be found that the actual experience gained in many localities will prove the published books of sailing directions meagre in many essential details, and not unfrequently erroneous in consequence of important changes having been effected, or taken place from natural causes, since the times of their publication. Depth of water at anchorage, currents or tide-ways of unusual force or direction, description of holding ground at different anchorages are particularly noteworthy; as also the particular winds experienced at different ports which render them secure and sheltered or otherwise.

It often times occurs that a yacht will be caught out in bad weather when coasting along, and meeting with an adverse tide in conjunction with a head wind, will undergo an exceedingly unpleasant buffeting in the struggle to maintain her position, much less to work to windward against such a combination of difficulties; there are many places of shelter around our coasts, lees of headlands, islands, indentations of the shore, &c., a knowledge of which can never be obtained from sailing directions, and yet where a yacht can ride out a time of difficulty in perfect security and shelter, and avoid wet jackets and a good dusting to her crew, besides the wear and tear to gear and sails. The cruising yachtsman should never let an opportunity pass of making himself acquainted with such stopping places, the depth of water, description of bottom, and amount of shelter afforded from stormy weather, for he never knows when such a haven of refuge may prove to him an invaluable resource. In falling in at sea with the local fisherman of a coast much useful information under this head can be obtained, and any opportunity of obtaining such should not be overlooked; besides that very often a pleasing diversity to the *cuisine* may be had from these hard working mariners at a rate of exchange, that would create an amazing amount of incredulity at Billingsgate. It has often been a matter of surprise to me, and thus alluding to fishermen reminds me of it, the remissness generally observable on board yachts in providing at least one locker well stowed with sea fishing gear, very few vessels indeed have I seen even moderately furnished with these essential requisites to a yachting cruise; and the material can be provided at such a moderate expense, whilst such an amount of spare time can be devoted on board for fitting up and keeping in repair the different descriptions necessary, that it is a matter of astonishment how such a department can

be so comparatively neglected. A few troughs of long lines, some bottom fishing and reeling lines, spare lines, hooks of different sizes, snouding, and a couple of good portable dredges would occupy but little space ; a seine net, and a few folding lobster drum nets would also be found useful ; a trawl net, fitted with a beam is rather objectionable on board a yacht, as the beam and its iron heads is much in the way on deck, and does not look well when carried alongside, but there is a net of this description called an "Otter Trawl," that is perhaps the most killing net that can be used ; this net is fitted with two wing pieces of elm some four or five feet in length, by two feet six inches or so in width, and an inch-and-a-half or two inches in thickness ; these are shod with iron on their lower sides so as to make them stand on edge when sunk to the bottom, and fitted on the inside with spans to which are attached the trawl bridle and warp ; instead of a beam to keep the mouth of the net open, there is a stout top rope fitted with corks or bladders. When sunk to the bottom the action of the water upon the pieces of elm or "Otters," in combination with the manner in which the spans are attached tends to make them travel wide apart, just as the line affixed to the middle or fore part of a fresh water artificial Otter causes it to travel out from the bank of a lake or river ; the corked top rope keeps the mouth of the net quite sufficiently open, and the bottom rope, as in an ordinary beam trawls, sweeps the ground most effectively ; the sizes of the otters must be of course proportioned to the net used ; those given will carry a much larger net than any beam ; and in fact a much larger net can be used by this method, than any proportional size of beam would admit. The Otter Trawl stows away in a comparatively small space and is peculiarly adapted for yachting purposes.

Nothing can be more exciting than a good day's reeling at sea, for mackerel or grey gurnet ; with a fresh moderate breeze, a clear sky and bracing air, the sport is most exhilirating ; and when the take is good a very acceptable addition is made to the ship's stores, by peppering, salting, and drying them in the sun or wind, or by pickling them. In a nice breeze the otter trawl, can be worked with amusement and profit, yielding up as its treasures, soles, haddock, turbot, plaice, and other profitable denizens of the sea : whilst during calms, or often whilst lying at anchor in open roadsteads, the bottom lines will produce cod fish, whiting, haddock, red gurnet, conger eels—*Et sic de similibus.*

If lying at a station near rocky bottom the lobster drums may be brought in operation, and should a level beach, or the mouth of a river present itself—the seine net will do good execution, as it will likewise should a shoal of herrings be fallen in with at sea.

I have seen a very killing net made use of in harbours, and roadsteads where there was not a very great run of tide, and which for its portability is peculiarly adapted to yachts: about six feet in depth and moderate mesh with a foot rope well leaded, and the back rope corked sufficiently to keep it upright in the water, it is sunk to the bottom across the mouth of a harbour or the run of the flood tide, and presents a wall of net when the fish begin to seek for their food; it may be used night or day, and left down either from dusk in the evening until daylight, or during the flow of the tide; its position may be marked by a buoy at one end, or a line made fast to the vessel; but it is as often set without any marks at all furthermore than a cross bearing taken of the position it is shot in; under the latter circumstance it must be found by sweeping with a small grapnel, and can rarely if ever be missed.

I have seen mackerel, herrings, grey and red gurnet, plaice, flounders, codling, and lobsters taken in such a net as this; lying at the bottom there is no fear of a vessel getting foul of it, and if it is not buoyed to mark its position no one is a whit the wiser of its whereabouts and it needs no watching; it may be of any length according to fancy.

In the pursuit of that now popular, facinating, and instructive amusement, the formation of Marine Aquariums, none possess such facilities as yachtsmen; the outlying islands, headlands, rocks and half tide reefs they meet in their cruises, teem with exhaustless specimens of the rarest and most prized specimens for Marine Aquaria. To the naturalist yachting presents a field of research ever varying, ever new; and one which will amply repay investigation: I quote from an authority on this subject as follows:—"From hence has arisen that special interest which belongs to the study of long neglected animal groups; and hence, also, has emanated a spirit of emulation which brings the naturalists of all countries to the sea-side, in search of objects of their study. The Marine faunas bear, indeed, very little resemblance to those of the land or air, or freshwater. The sea contains entire groups belonging to special types, which have no representatives elsewhere. Here live almost exclusively those singular beings which are often of considerable size, although the animal organization is reduced to its simplest expres-

sion, seeming almost as if they were objects fitted by the hand of nature for elaborate experiments in physiology, and which it is sufficient to know, recognize and interpret. It is here more especially that we must seek those animals of abnormal external forms and exceptional organic arrangements, which open to the student of nature vast and ever varied fields of enquiry."

To yachtsmen who may wish for detailed information to enable them to become initiated in the pursuit of marine zoology, and the investigation of the many curious objects that everywhere meet the eye in coasting cruises, I should recommend them to make the acquaintance of Mr. W. A. Lloyd, at his aquarium warehouse, Portland Road, Regent's Park, London; the researches of this gentleman both by sea and land entitle him to a high rank as an authority on the subject, and a visit to his collection will amply repay the wandering yachtsman who has a day or two to spare in London. If I err not his amazement will be excited at the marketable value put upon objects that he has hitherto but casually noticed as of but little import, or passed by with listless indifference; to say nothing of the interest that will be aroused and the incentive given for profitably occupying much, otherwise wasted, leisure time, in investigating the organization and habits of the mysterious inhabitants of the sea and its shores. Mr. Lloyd has published an excellent little hand book on marine and freshwater plants and animals, replete with information upon these subjects, and also containing ample instructions as to the various apparatus and appliances, the methods of preserving and transmitting specimens alive, and of the most approved modes of constructing aquaria.

Another capital little work is that by the Rev. J. C. Wood, M.A., F.L.S., entitled "The Common Objects of the Sea Shore," published by Routledge and Company, from which much interesting and instructive matter may be gleaned. There is not a bunch of seaweed that floats the ocean, or crests the rock-bound shore; not a little half-tide pool or rocky basin that will not amply repay investigation and furnish forth objects of interest sufficient to occupy and instruct many an hour that is often spent lounging idly on deck.

The Museum of that well known yachtsman and naturalist, Thomas Campbell Eyton, Esq., of Eyton, Wellington, Salop, affords a striking instance of what a Naturalist may achieve whilst enjoying the pastime of yachting. It is a model for any yachtsman, similarly inclined, to follow,

being I believe one of the most, if not "the" most, complete collections of the British Isles in existence, and the majority of the specimens have been obtained and preserved by the gallant owner himself during yachting cruises. The Channel Islands, Scilly Isles, Saltees, Bardsey, English and Irish Skerries, Lambay, Isle of Man, Copelands, Maiden Rocks, Craig of Ailsa, West Coasts of Ireland and Scotland, Bass Rock, Shetlands, and Orkneys, are amongst the infinitude of localities wherein the yachtsman often finds himself, and where, what may be called "the Naturalist's treasures" are scattered by nature with a lavish hand. When we compare the ardent students long run by rail to the sea coast, when the uncertainty of success in his pursuit, and the confined space to which his research must be limited, and contrast it with the boundless resources enjoyed by the yachtsman, living in his little floating palace, cruising from island to island, and shore to shore, independant of rail, coach, or car, and enabled to effect a landing at places that attract the wistful glances of the landsman, it is matter of surprise that this facinating pursuit has not ere this become more popular with yachtsmen.

Of sea-birds, noble specimens are at all times within his reach, gulls, tern, cormorants, gannets, guillemots, and puffins, he can pick and select *ad infinitum* swarming on the outlying islands. A gannet decoy affords no little amusement when the birds are numerous and voracious for food; a piece of board, as near the colour of the sea as possible should be veered astern for a considerable distance by means of a log line; upon this if a piece of cod liver or any description of small fish be fastened, the gannet will pitch from an almost incredible height upon it, and dislocating its neck in the concussion with the board, will fall an easy prey; some noble specimens may be secured in this way without injuring the plumage by shot.

The eggs of marine birds may be found in great quantities on rocky islands about our shores, and many of them are excellent additions to the table when boiled hard. The curlew of all sea-birds, always excepting the wild duck, constitutes a by no means despicable addition to the yachtsman's larder; they require however to be kept for some little time before being used, and those versed in the mysteries of the *cuisine*, say, that a curlew should be hung up by a single feather of the tail, and upon dropping from this is fit to receive the attention of the cook. Capital shooting may be enjoyed with curlew by watching their

flights to the feeding grounds on the coast at low water : by conceiling oneself amongst rocks in their line of flight at the commencement of ebb a very respectable bag of curlew may be made; so long as the human form divine is kept out of sight the otherwise wary curlew will maintain a steady flight over the shooting hole, but once let the shiny top of an oilskin hat, the glint of a gun barrel, or the tip of a finger appear above a rock, and, this wariest of all wary sea-birds shifts helm at once, and strikes another flight.

## CHAPTER XXXIII.

"Then up and spake an old sailor,
  Had sailed the Spanish Main—
'I pray thee put into yonder port,
  For I fear a hurricane.
Last night the moon had a golden ring,
  And to-night no moon we see!'
The skipper he blew a whiff from his pipe,
  And a scornful laugh laughed he."—LONGFELLOW.

Now, Mr. Yachtsman, having accompanied you clear away from your anchorage, or moorings, for a cruise, we will presume that you are fairly at sea; your boats stowed away on deck after the manner we have before treated upon; the anchor stowed, chain cable run down into its locker, and the hawse holes plugged; for this latter purpose neat plugs or tompions, sometimes called bucklers, made of either wood, or canvas rolled into the form of a plug, are very necessary, as when a vessel pitches into a head sea, if the hawse holes are not plugged, the water spouts in over the forecastle and although we must take wet and dry chances as they come, yet it is as well to keep a little ship as dry and comfortable as possible as long as we can. We will presume that the start has been made in the morning, and that there is a leading wind; that the vessel (we shall assume her to be a cutter) is under mainsail, foresail, jib, and gaff-topsail; if the course lies along the land, or, as it is commonly called, a coasting cruise, the various headlands and well-known points of the coast will give accurate data as to the speed the vessel is progressing at, by measurement on the chart; but if bound away to sea, then a departure must be taken from the last headland or point likely to be seen, and the method of doing this and working it will be found at page 26 of the "Sailor's Sea Book," and from this period commences the "day's work," when every change of wind, course steered, allowance for lee way, and general observations must be entered in the "Log Journal." With a leading wind (*i.e.*, a wind blowing a-beam of a vessel, and enabling her to continue her cruise, or return to the port she has left without tacking), the course can be laid at once for

the port it is designed to arrive at, and the next thing to be done is to ascertain as accurately as possible the rate of sailing she is making through the water. There are two methods of doing this—one by the common log, the other by Massey's patent log. The common log consists of a flat piece of wood called the log ship, in the shape of a quadrant, the circular edge of which is loaded with lead sufficient to make it float upright in the water; to this is attached, by spans, a line called the log line of about 120 fathoms in length. One of the spans that attaches the log line to the log ship is made fast to it by a wooden peg, so that a stronger pull, or a chuck of the line, may disengage this span, and by allowing the log ship to fall flat on the water, permit it to be hauled on board more easily than if kept in an upright position.

The principle upon which the log line is divided is as follows:—The length of a nautical mile is about 6,079 English feet, and the 120th part of this is 50ft. 8in. Now the 120th part of an hour is 30 seconds, so that the line should be divided into knots of 50ft. 8in. each for a glass running 30 seconds; but as the log is apt to be drawn after the vessel, and as it is better to have the reckoning rather before than after the ship, 50 feet is thought to be sufficient for the length of a knot to a glass running 30 seconds. It is usual, however, to use a glass running 28 seconds to a knot of 47ft. 4in., or say 48ft.; such a knot being divided into 8 fathoms of 6ft. each. When a vessel is sailing more than 5 knots an hour, a 15 or 14 second glass, called a quarter minute glass, is used, and then the number of knots reeled off should be multiplied by two, in order to give the entire distance made good.

The log line is wound on a reel; 12 fathoms from the log ship a bit of white or red bunting is inserted, which 12 fathoms is called stray line, in order to allow the log ship to be carried away clear of the ship's wake before the reckoning begins; from this bit of bunting the log line is marked into knots by smaller pieces of line inserted in the strands, and knotted with the number of each knot—1, 2, 3, &c. The log reel revolves freely on an iron spindle with handles at either end.

To use this instrument is called "heaving the log," and is performed in the following manner: one hand takes the log reel, putting the wooden plug of the loose span moderately tight into the log ship, and resting one of the handles against the bulwarks or rail on the lee quarter of the vessel; another hand takes the sand glass and stands ready with the full globe downwards; the officer of the watch then heaves the log

ship overboard, which floats away upright and steadily astern of the vessel, the man at the reel taking care that the log line pays out handsomely and without any checks as the log ship will take it. Immediately that the piece of red or white bunting marking the stray line goes over the taffrail, the officer of the watch sings out to the man with the sand glass "turn!" to which he should answer "turn it is!" The log line continues to be paid out steadily until the sand in the glass runs out, when the man holding it cries "stop!" Then the log line should be snatched on the moment, and the number of knots reeled off denote the number of miles per hour the vessel is sailing. If the vessel is sailing before the wind, and a heavy sea following her which will bring home the log, it is usual to allow one mile in ten, or less in proportion to the sea. If there should be a heavy head sea, a similarly proportionate allowance should be made for the log ship being taken out fitfully by the waves.

A yachtsman should make himself expert at the outset in heaving the common log whilst cruising, by which means, in a very short time, he will be enabled to judge to a nicety at what speed a vessel is going, and for general purposes may soon dispense with more than the occasional use of it, except when upon a long cruise, then it should be hove regularly. It is also necessary to be cautious where a current or tide is known or suspected to exist, as in such a case extreme care must be used to arrive at a correct knowledge of the actual speed. For instance, should the log indicate a speed of ten knots an hour, and that a tide or current is running against the vessel of say three knots an hour, the actual speed will be only seven knots, and she will have only changed her position by that distance, whereas, should this tide be in her favor, she will be sailing at the rate of, and gone over, thirteen knots in the hour. Whilst coasting, tides and currents should be most particularly attended to, as along the shore they are strong and vary much according to the times of flood or ebb. In the open sea the tide has comparatively little effect beyond the mere tidal wave, but ocean currents frequently occur, independent of tide, and as they are very treacherous and difficult of detection, these must by no means be overlooked.

In sailing across tides, as, for instance, those encountered in parts of the St. George's and English Channels, the leeway caused thereby may necessitate the allowance of a quarter, half, or whole point of the compass; the leeway to be allowed from the wind. The inclination of the wake of a vessel from the line of the keel is an excellent criterion

whereby to judge the allowance necessary to be made for leeway; but in this, as in many other details connected with the glorious pastime of yachting, every little opportunity that presents itself, whereby practical experience can be gained, should be eagerly seized upon, and here a well-kept log will enable a yachtsman to husband information that will be found of great utility for reference upon other and future occasions. The knots of the log line should be occasionally measured with a rule to verify their correctness, and the line should be wetted when this is done; the sand glasses should be kept in a dry place, a small locker near the cooking galley may be set apart for them, so as to ensure the sand being dry and running freely; they should also be tested occasionally by a watch with a seconds hand, or by the following method:—hang a plummet on a nail, taking care that the distance between the nail and the centre of the plummet is exactly 39¼in.; then the plummet being set swinging the number of times it passes under the nail while the sand is running out, will denote the number of seconds the glass runs.

Massey's patent log is an excellent instrument, and now in general use. Many other instruments have been invented to measure the speed of vessels at sea, but none seem to have obtained so great a measure of public favour as Massey's. It consists of two parts, the register case or log of brass, containing a series of wheel work connected with three small dials on its upper face; each of these dials is fitted with an index hand, and register respectively 1, 10, and 100 miles. The rotator is an elongated cone of brass to which are fitted vanes, and the rotator is attached to the log itself by a couple of fathoms of line; the vanes on the rotator are adjusted by very accurate experimental trials, so that its revolutions in the water are communicated to the wheel work of the log in such a manner as that when the machine has passed through one mile, No. 1 index hand registers it or any part of the mile; No. 2 registers one mile or one-tenth of its circumference; and No. 3 will register an advance of one-hundreth part of its circumference. In this manner the log will register any part of or up to 100 miles. If, however, the vessel alters her course, the log will have to be taken up and the fingers of the index plates set afresh, in order to give the exact distance sailed upon each separate course. This log is attached to the vessel by a tow line of from 20 to 50 fathoms in length, according to the size of the yacht, so as to keep the machine out of the wake: this is an important point in using it, as if it is not kept at a sufficient distance

astern, it will not register so many miles as the vessel sails. When the log is about to be used, it should be connected to the tow line by the spring catch adapted for that purpose; the index hands should then be set at the beginning of their points of registry—namely, the first at 1, the second at 10, and the third at 100; and then the brass cover shut over them to prevent any seaweed or other floating matter getting in. Both register box and rotator may then be thrown overboard, and allowed to tow astern. There is a piece of iron in the form of a cross adapted for the purpose that should be made fast to the tow line near its junction with the register box. The object of this is to catch sea wreck or any other substance that might foul the rotator and prevent its acting. It is of importance that the wheel work, &c., of this log should be kept rubbed over with sweet oil in order to prevent verdigris forming, and to ensure its correct working.

There is also an admirable sounding machine patented by the same inventor, upon a similar principle to the log, which registers the depth of water most accurately, and as a cast of the lead will very often verify the position of a vessel, Massey's sounding machine will be found of great utility on board a yacht, more particuliarly for deep sea sounding.

As "lead, log, and look-out," is a watch-word that should always be borne in mind by a yachtsman, I will here introduce a description of the ordinary leads and the marking of the lead line. The usual lead used for general sounding weighs 7lbs. There is an eye in the top with a leather becket fitted to it; there is also an eye spliced in the end of the lead line, which goes through the leather becket; the lead is shoved through the bight, and hauled taut. There is a hollow or cup formed in the bottom of the lead, which is filled with tallow, or, as it is technically called, "arming," in order to bring up a specimen of the bottom, or "soundings;" sometimes the 14lb. lead is used, fitted in a similar manner. The hand lead line is generally about 25 fathoms in length, and is marked as follows: at 2 fathoms two strips of leather; 3 fathoms three strips of leather; 5 fathoms, white rag; 7 fathoms, red rag; 10 fathoms, a piece of leather with a round hole in it; 13 fathoms, blue rag; 15 fathoms, white rag; 17 fathoms, red rag; and at 20 fathoms a piece of cord with two knots on it. These depths are called "marks," and the intermediate ones "deeps;" thus, if the leadsman strikes 5 fathoms, he sings out "mark by the 5;" if he gets 6 fathoms he sings out "by the deep 6;" at the same time describing the bottom

as hard or soft sand, pebbles, shells, mud, or rock: the only fractions of fathoms used are "a half" and "a quarter;" thus if $5\frac{1}{2}$ are obtained he sings out "and a half 5;" if $5\frac{3}{4}$ "a quarter less 6." In heaving the hand lead the leadsman should stand in the weather channels, and giving the lead a swinging motion—even once or twice over his head to give it sufficient impetus—heaves it as far forward as possible, and then as the vessel forges ahead he should draw the line taut from the lead at the instant it becomes perpendicular to him, giving it two or three jerks on the bottom to fill the arming and noting the "marks" or "deeps" as he does so. In sounding in deep water from a small vessel, it is advisable to give her a shake up in the wind, but the lead should be hove before the way is deadened so as to give time for the line to come up and down, and thus obtain the depth with greater accuracy. The deep sea lead weighs 28lbs., although sometimes a 14lb. weight may be found sufficient. The deep sea lead line is marked in a similar manner to the hand line up to 20 fathoms, after which, pieces of cord with an additional knot to every 10 fathoms, and a piece of leather between each to denote every 5 fathoms. When using this line the lead should be taken to the bows of the vessel and the line made up into several coils, each coil to be held by hands stationed along the side of the yacht for the purpose. It will be found necessary nearly at all times, except she is going very slow indeed, to heave a yacht to to obtain a deep sea sounding; when this has been done, and the line passed outside the rigging on the weather side, the leadsman should heave the lead well forward; as the last fake of his coil leaves his hand, he should sing out to the man next to him—"Watch ho—watch!" This warning cry should be repeated to the next, and so on to the last man, in order that each may be prepared to pay out his coil handsomely as the lead takes it.

Amongst the instruments that have been patented both for measuring the speed of vessels and the depth of water, may be mentioned the following: A patent log, invented by the Rev. — Berthon, of Fareham, Hants, consisting of a brass tube going down through the keelson and keel, and connected near the deck, in some convenient place, such as the companion hatch, with an index plate similar to a barometer, or, as fancy suggests, a clock dial. To use this log the tube must be pushed down until it projects some six or eight inches below the keel, when the pressure of the water, which is admitted through a small hole in the

tube, acts upon a peculiar internal arrangement, by which a column of mercury, or the hands on the clock face are made to indicate the number of knots a vessel is sailing at; by turning the tube so that the hole at the bottom shall be presented to the port or starboard side, the amount of leeway may also be obtained. Very favourable accounts have been given of this log—it has been fitted to one of her Majesty's yachts and several of the different yacht club vessels; but either from its expense, or the difficulty of fitting it, and the trouble entailed in its repair should anything foul the tube below, although an exceedingly clever invention, it has not come much into general use. Mr. Berthou has also invented a sounding apparatus, in which the pressure of the water at various depths is made to register through a pipe, on an index plate kept on deck, the number of fathoms to which the lead descends.

Ericcson has invented a lead, by which the depth of water is indicated by pressure on a column of air contained in a glass tube and reservoir fitted within the lead; the height to which the water rises in the tube indicating in a graduated scale the number of fathoms to which the lead has descended. These latter are more suitable for scientific surveys than for the rough-and-tumble of cruising work. However, as many of our yachtsmen devote much attention to scientific pursuits during their cruises, I bring these inventions under their notice, so that, if disposed, they may avail themselves of them.

Burt's buoy and nipper is an instrument well known amongst nautical men, and assists materially in obtaining correct deep-sea soundings when a vessel, owing to the violence of the sea, or other causes, cannot be kept steady enough to allow sufficient time for the deep sea lead to reach the bottom. This instrument is used by reeving the deep sea lead line through a spring catch or nipper attached to the buoy; the lead is then hove, and the buoy thrown overboard into the water; the line runs freely through the nipper until the lead touches soundings, or until it is checked by a pull, when the spring catch clutches the line and attaches the buoy exactly at the depth descended through by the lead.

Having thus mentioned the principal instruments necessary to measure the speed of a yacht, we shall return to the subject of the cruise. As a quick passage from one port to another is always indicative of smart handling and good navigation, a yachtsman should be prepared in every way to overcome whatever difficulties may turn up, and, if possible, to convert them into advantages; therefore some attention should be paid

to the trim of the canvas, so that a vessel may not have too much head or too much after canvas, which will cause her to steer badly and prevent her putting forth her best speed. If she has too much after canvas she will have a tendency to "gripe," or run up into the wind, necessitating a hard weather helm, and the rudder being thus forced too much across the line of her keel, the water will exercise a powerful antagonistic force, and act as a drag upon her; if too much head canvas be carried, she will run off her course, and a lee helm will be the consequence, thus throwing the rudder at an opposite anglo, and not only causing a drag, but putting her in a dangerous trim, as should a squall strike her, she will not answer her helm quick enough to relieve her from the weight of the wind. The head canvas should be proportioned so as to balance the after, and give her at the same time a slight weather helm. A trick at the tiller will soon show a yachtsman whether she is in good sailing trim or not; if the tiller vibrates gently, and presses moderately against the hand, and that she answers to the slightest touch of it, lifting buoyantly to every little ripple and swell as if she was taking breath, the little barkie is doing well; but if she seems heavy and sluggish, takes much of the helm and answers it slowly, then something must be wrong, and the sooner it is remedied the better; a smaller jib, or easing in the one that is set a few inches on the bowsprit, may remedy her lee helm, and *vice versa* a larger one, or heaving out that which is set chock a block to the bowsprit sheave may obviate a tendency to gripe. Cruising canvas should always be balanced to three sails—namely, the mainsail, foresail, and jib; the addition of the gaff-topsail will, as she can only carry it in fair sailing weather, just give her a little more weather helm but nothing to hurt her speed; sometimes the way a vessel's ballast is stowed will tend materially to interfere with her sailing, and cause her to steer badly and perform but very poorly in a heavy sea. Too much care cannot be taken in stowing the ballast at the outset: if it is spread along her bottom right away fore and aft, it will make her sluggish in a lump of a sea, wet, and slow to her helm. It should be concentrated as much as possible in her body closing up to her greatest beam; this will make her corky, light, and quick under canvas.

If a vessel has a deep forefoot it will cause her to gripe, and she must be fitted with a longer bowsprit and carry a larger jib in proportion; this is a very great fault in a yacht, which can only be effectually reme-

died in the dockyard by rounding up the forefoot, so as to decrease the draught of water; but under way the only chance of getting her to rights is by hauling down a reef in the mainsail, or sailing her with an easy mainsheet, if the reef in the mainsail proves too much reduction of after canvas. In a schooner this can be more easily and effectually remedied by taking a reef in the mainsail, there not being so much likelihood of overdoing the thing as in a cutter, the effect of the sails not being so much concentrated. The trimming of the sheets will have an important effect upon her speed according to the weather; if the water is smooth and a nice moderate breeze blowing, when sailing on a wind they may be pinned in taut, so as to make every inch of canvas tell; but if there be a lumpy sea on then she will not like them so taut, she must have free working play of her sails, so as not to press her into the sea, but to lift her and keep her going over it. A yachtsman should never be lulled into fancied security at the commencement of a cruise by too fine weather; everything should be prepared to meet all changes and chances that the fickleness of sea or wind may render probable. The mast should be well greased so that the hoops of the mainsail may work freely; the forestay also will require a touch of tallow that the hanks of the foresail may run sweetly upon it. Grommets are not advisable fittings for a foresail, except it be to a balloon foresail that is used for fine weather racing; they catch very often on the stay and prevent the sail being hauled down as quickly as necessary. And as there is no more pressing sail in a cutter it requires to be handled smartly in squally weather. The blocks should be overhauled and the sheaves oiled to make them run freely, and if any new running gear has been bent it requires looking after so as not to choke the blocks or kink when running. Safety gear should never be neglected, as is too often the case, by waiting until it is wanted, and perhaps when it is too late to derive any beneficial assistance from it. The downhaul of the jib should be bent to the head, and the fall belayed to a pin set apart for it in the spider hoops of the mast; if it is found requisite to take in the jib smartly, it is of vast assistance in overhauling the halliards, and should they by any mischance be carried away, the head of the sail can at once be secured instead of flying away to leeward and beating to ribbons in the sea, or getting under the fore-foot. An inhaul fitted with a pair of spans or legs should be seized with a leg on each side of the jib traveller, so as to enable the crew to haul in the jib evenly on the

bowsprit. When running off the wind a jib cannot be let fly in as if a vessel were close hauled, and besides when cruising it is advisable to save wear and tear of gear and sails as much as possible. It is desirable of course to handle canvas at all times as smart as possible, but the "slashing away" style of racing is not advisable so far as economy of material is concerned whilst cruising; and, indeed, if work is carried on smartly during such voyages, when it comes to racing, a well-trained crew will be found quite equal in smartness to the work required of them.

If it is of moment that a jib should come in extra quick when a vessel is close hauled, then there is no doubt letting go the jib pendant is the way to do it; but when on a cruise, and that the jib requires to be shifted, then by easing the pendant handsomely, and manning the inhaul, very little time will be lost.

The foresail downhaul should be bent to the head thimble of the sail and rove down inside the hanks alongside the stay, the fall led through a sheave in the stem head, alongside of that through which the fore tack is rove, and made fast upon a cleat nailed for that purpose on the fore-side of the bitts; then the moment it becomes requisite to douse the foresail by casting the halliard off its pin and manning the downhaul, it is off the vessel in a "quarter less no time."

The gaff-topsail clew-line should, as I have said in Chapter XXXI., be made fast by the standing part to the gaff-topsail yard, then rove through a thimble in the leech near the sheet, up through the small tail block bent to the yard, and the fall belayed to the boom.

There should always be at least two reef pendants rove ready for reefing the mainsail, they will never be found in the way, and it is always much better to have them in their places, no matter how smooth the water or sunny the sky, than be looking for them when wanted. These should be well greased and rove "up" through the score cut for their stand-parts in the boom cleats, through the reef cringles on the leech rope of the mainsail, and "down" under the brass sheaves in the cleats. The reef tackle may be hooked on to the boom and the lower pendant bent to it with a Blackwall hitch. If, as is often the case, the pendant proves too large to be hitched on the hook of the reef tackle, then an overhand knot should be taken on the end of the pendant and the tackle hooked on the after side of it; but the neatest and most ship-shape method is to have straps and toggles. The reef tackle being well over-

hauled and hitched to the boom by the fall just on the fore side of the after block, the pendant will hang slack and not girth the mainsail leech, whilst all will be ready for hauling down the first reef at a moment's notice. The second reef pendant should be rove slack also and the end made fast to the boom; for this purpose reef pendants should be neatly pointed, and a small eye worked on the point. The main-tack tricing line is a portion of the safety gear not likely to be overlooked, yet still I shall not omit it in the catalogue: it should be a gun-tackle purchase with the lower block fitted as a tail block. This lower block should be bent to the maintack thimble, with the fall of the tail hanging free. It is often requisite during a squall, or if the vessel's speed is desirable to be stayed, or when entering a harbour through a fleet of vessels, in order to enable the helmsman to see to leeward, to trice up the tack of the mainsail smartly. Irrespective of this, there is another very important use for the tricing-line, for by hitching the tail fall of the lower block round the boom, the tricing-line becomes an effective downhaul to the throat of the mainsail, which is frequently found of considerable assistance in blowing weather when hauling down the mainsail to reef it. The peak downhaul answers for ensign halliards as well, and is rove through a small copper-bound block at the gaff end; the falls are taken well in-board and belayed to a cleat nailed for the purpose on the under part of the boom. This, in conjunction with the tack tricing-line will enable the mainsail to be kept in control.

I shall, I trust, escape the charge of tautology in thus recapitulating a list of the items of safety gear, as I have mentioned some of them previously; but I cannot too forcibly impress the necessity of seeing all this gear properly rove and belayed in their places at the commencement of a cruise. If such matters are attended to at the outset there is but little fear of their being neglected afterwards. Amongst yachtsmen of the present day we have many first-rate navigators, and men who understand the making and taking in sail thoroughly; yet, strange to say, there is a remarkable paucity of first-rate helmsmen. Why this should be the case it is difficult to understand, for there is no more mystery about steering well than there is in reefing a foresail; all that is required is practice and a little perseverance, and whilst cruising is the yachtsman's time to make himself thoroughly master of the movements of his vessel; no matter how skilful he may be in other respects, he never can be perfect until he becomes a really good helmsman. Many may think

it monotonous or tiresome, or feel a diffidence in taking the office out of the hands of the sailing-master or members of the crew, and no doubt there are many that think it *infra dig* to pay hands and work themselves, but no thorough blue jacket will allow such consideration to weigh for a moment. Probably sometimes the "authorities" in the forecastle may think it politic there should exist an impression that in one department at least they should reign paramount; but this is an exception in particular cases, and by no means the rule. On the contrary, if the owner or any of his friends cruising with him be good helmsmen, it will give the regular crew more time for any little jobs that require to be done, and when canvas comes to be shifted it leaves more practical hands at liberty to assist; therefore; it is an advantage of no mean importance when looked upon in this light, and the majority of crews are rather pleased than otherwise when they know there are some good hands at the steering stick abaft the companion.

In steering, a yachtsman should always stand to windward of the helm, he will see better to the trim of his canvas and in the direction of his course, besides having more command of the vessel. Standing to leeward with the weather tiller rope rove over the tiller is a very bad habit, and some ugly and fatal accidents have occurred through this practice; if it is blowing fresh and the weather tiller rope should by any accident give way, the helmsman may lose his equilibrium and be canted overboard by the jump of the sea; besides, there is not the came control over the movements of a yacht, nor can she be steered to the same advantage. A knowledge of the action of the rudder in guiding the vessel is of preliminary importance; when it is placed at an angle with the keel it is not the bow of the vessel that is actuated by the pressure of the water on the rudder, but the stern is pushed aside. Apparently there is a point in the vessel's length on which she turns as on a pivot, and this is variable according to the build of the vessel and the extent to which the rudder is put over. If she is a long, lean-sided vessel this imaginary point will seem further forward and the vessel appear longer in answering the tiller; if she is a round-sided craft it will appear to be further aft and the quicker she will yield to the influence of the rudder. As a general rule this imaginary pivot will seem to be about two-thirds of the length of the vessel from abaft.

The fact of the stern of a vessel being pushed aside in the ratio of two to one to the bow should never be lost sight of, for in rounding a

buoy or flag-boat, or avoiding a collision in harbour when another vessel's bowsprit or stem has to be shaved very close, the recollection of this will enable a helmsman to avoid a nasty collision, for just at the moment that the touch of a vessel's quarter or counter may appear inevitable, by putting the tiller judiciously over, her stern will be shoved wide of the object. In the same way when rounding a mark, a yacht must not be allowed to pass it too far before the helm is given to her, as if so she will make a sweep too far to the other side of it and leave room for another yacht better steered to cut inside and cover her.

There are many conflicting opinions as to the best angle that the rudder should make with the line of the keel to produce the greatest effect without diminishing the speed of the vessel. It must be borne in mind that the nearer a rudder is placed to a right angle with the keel the more it tends to stop her way, and the less effective it is in turning her. From 35° to 45° with the line of the keel is considered to be the best, but this is to a great extent dependant upon the judgment that practical experience with the performance of any particular craft will enable the helmsman to form. One thing he should ever remember, that the less helm that can be given to a vessel in proportion to the result desirable the better; a yacht that requires much helm must be defective in some one of the three essentials—viz., perfection of balancing of sails, stowage of ballast, or form of the hull in reference to the draught of water forward.

Coolness and self-possession is of great consequence in steering, and this constant practice alone will give. When steering by the wind a vessel should be kept a good clean "full and bye:" by this expression is meant that all the sails are full and doing their duty, whilst at the same time the vessel is going as close to the wind as she possibly can be forced. A dog-vane or a burgee will be of great assistance to a beginner, and indeed at all times when nice steering is required; but as either is of little use during a dark night, a yachtsman should accustom himself to steer by the wind by the feel of it blowing on his face. This at first may appear difficult, but by practising it during the day time it will soon be overcome. The luff of the mainsail will by shaking give the first indication that a vessel is being kept too close, and should the jib lift next, the barkie will be all in the wind and not doing her business; the least touch of the tiller will keep her away again. But this luffing and keeping away in an even blowing breeze is bad work, and yaws a

vessel about to the great hindrance of her speed. She must be kept going steadily with a loose, yet at the same time quick, hand on the tiller. If a yacht be observed when at anchor in a tideway, the unequal effect of the water in rushing past on opposite sides of her rudder, causing the tiller, if shipped, to yaw about considerably, will point out that the same effect will be produced from a similar cause while underway and the more so should there be a rolling sea; consequently, whilst a steady helm constitutes the great beauty of good steering, still there must be a certain give and take motion of the tiller to humour the water in passing the rudder. But at the same time a sculling motion must not be indulged in—this is not only excessively ugly in appearance but injurious to speed. If the tiller be grasped too firmly the vessel will yaw about, and then must get lee or weather helm to steady her again; she must therefore be humoured judiciously, just like a spirited horse, yielding to her motions, yet at the same time keeping her under perfect control, and taking care that the full force of the wind is exercised upon her sails. With the wind blowing abeam and the sheets eased off, a firmer grasp of the tiller is necessary, as the faster she goes the quicker she will require any little correction, and on this point of sailing she will also be steadier. The wind abaft the beam, quartering, or dead aft requires the nicest exercise of the helmsman's skill, the more particularly should there be a heavy following sea. In this case she will have a tendency to steer wild, and must be carefully attended to. She will come up heavily to the wind, and the sea taking her quarter will incline her to broach-to, and when falling off again she will do so with a slack tiller, the mainsail caved in on the leech, and apparently about to jibe.

Both of these movements must be anticipated by a touch of the tiller to windward or to leeward a few moments previously, and so timed that between both a straight course shall be kept; in fact, the bowsprit end should be kept as it were revolving round an imaginary point ahead. If at any time she ranges away to leeward so as to endanger the mainsail jibing, the helm should be put down sharp to meet it. This is a critical moment, but the helmsman should never be flurried; when checked in time she must come up again, although she may appear to do so slowly. The helm should not be put over too much or suddenly, as if it be, the following sea striking against the rudder may force the stern over, and cause the mainsail to jibe, and the lee runner being eased away, the boom

may be thrown over with such violence as to carry away the weather runner and endanger the mast. If the helmsman loses his coolness at such a time and rights the helm, the mainsail is sure to jibe; the safest and best way is to keep the tiller down, and by no means to shift it unless a jibe becomes inevitable, when it should be at once put over, so as to ease the shock and save the mast. This result, however, can only occur through gross negligence in steering or a sudden shift of wind, and one lesson will be sufficient to ensure its being guarded against. The helmsman should concentrate his every faculty and energy on his sails, and the motions of his ship in a fresh breeze, and not allow his attention to be distracted by conversation, viewing the land or tactics of any other craft in his vicinity; to steer a straight course, regulating the movements of the yacht with the least application of the tiller possible, and a strict attention to every variation in either the force or direction of the wind will afford him plenty of occupation in a rattling breeze and heavy sea; and if he is a thorough-going salt no small amount of pleasure also.

I do not know anything more glorious or exciting than to stand at the tiller of a noble yacht, with a slashing breeze making her leap through the seas, the spoondrift flying out from her lee side in showers of flaky foam, feeling oneself the master of her every motion, and she like a thing of life answering every thought of the brain and every movement of the hand; topping the white crested waves like a bird, gliding swiftly down the hollows, nipping now and again little foam wreaths over her snowy deck, and anon cleaving through a giant billow, scattering rainbows of sea froth like pearls, and rubies, and sapphires around her; agreeable companions on the quarter-deck; a stalwart, active crew forward, a full bread locker, a brimming beef cask, and the grog tub damp, with a pleasant port and kindly friends looming at the end of the bowsprit. In steering there is nothing more conducive to the feeling of command over a vessel's movements as easy and secure foothold, or as Jack commonly designates it, "having one's sea legs well shipped!" To accomplish this the feet should be planted firmly on the deck, grasping, as it were and well apart; the knee joints loose and pliable, and the body swaying over them easily, keeping time with the movements of the little ship, the arms loose and independent, and ready for any duty required. The physical comfort enjoyed by practising this position must be felt to be appreciated; if the knee joints are kept stiff and awkward, the feet close

together and toddling about at every jump of a sea, the hands and arms kept nervously ready to clutch at anything for support; the good yacht will soon kick the tiller under her bobstay, and walk away with the chain cable in her teeth. The old saying that "one foot to windward is worth a fathom to leeward!" must occupy another niche in the yachtsman's memory when beating to windward, and every change of force in the wind stronger than usual must not be thrown away by driving the vessel heavily through the sea to show how stiff she is, or the pluck of the helmsman; but it should be taken advantage of by sailing her close and nipping her up in the wind's eye, eating into it as if she had a screw to leeward pushing her bodily to windward; the weather gage is the surest position, and always gives the vessel a command of resources. In the same way an adverse tide may be made to serve the occasion by taking it under the lee bow and making it force her to windward. This will require nice and steady steering, watching every fresh puff and then taking a push from the tide, again keeping full in the lull of the breeze and bursting up the run of water fairly with the stem, lest that the advantage be lost by getting too strong a hint from old Father Neptune in the shape of a kick sternwards instead of ahead.

## CHAPTER XXXIV.

" Wounded and fettered, 'cabin'd, cribb'd, confin'd'
Some days and nights elapsed before that he
Could altogether call the past to mind;
And when he did he found himself at sea
Sailing six knots an hour before the wind.'"—BYRON.

WHEN starting for a cruise a yachtsman will do well to remember that there are a few more details necessary to be considered and thought over than merely getting a vessel ready for sea; the state of the weather and the tides will repay a little investigation, so that unnecessary delay, or adverse circumstances, may be avoided. There are many hardy blue-jackets that laugh to scorn any precautions under this head, but boldly strike away to sea at once, and, as they say, "Look for whatever weather or tide chance may afford them!" Young yachtsmen are prone to this sort of thing, as they think they never can get weather excitement, or change enough, and are burning to record their experiences of gales of wind, and to become experienced veterans all in a moment; but the fable of "The hare and the tortoise" is very often exemplified in such hasty and incautious commencements, and although a good deal of knowledge may be gained if coolness and judgment be exercised, yet the probabilities are that the novelty of a fresh gale and tumbling sea may be more than counterbalanced by the discomfort and want of success which a hard struggle against a contrary wind and adverse tide is sure to entail, and that weariness and disgust may be engendered, when, after battling hard for many hours, they are forced to bear up for the port they have left, wet and weary, with a tired crew, and vessel knocked about considerably in sails and gear; a little foreknowledge with a trifle of patience might avoid such disagreeable *contretemps* as this, and a few hours may be spent much more advantageously in a snug harbour or roadstead, than by knocking a vessel and crew about uselessly, without advancing a mile upon one's voyage. At the same time too much caution must be avoided, not only as interfering with the acquisition of that practical experience it is so desirable a yachtsman should gain, but as leaving him open to the charge of being timerous and uncertain, and

giving an opportunity to his crew to practice upon his credulity, for some yachting Jacks are well known to have a remarkable partiality for comfortable quarters, and can get up gloomy forebodings of threatening gales, squalls, and rough weather with surprising facility, and not a few cruising yachtsmen have nearly grounded on their beef-bones in pleasant harbours through want of confidence in themselves, or the neglect of studying the symptoms of weather, lending too facile an ear to the mysterious nods and winks of lazy skippers, or shore-lo ving fore-mast Jacks, who think one place just as good as another to fill up a yacht's log in, more especially if there is a convenient landing, good markets, and an agreeable grog shop.

It is into either of these extremities, viz.—rashness or over caution, that a young yachtsman is so likely to run; and his accomplishments as a seaman cannot be considered perfect until he has acquired a fair share of weather-wisdom, a knowledge of the tides with the influence of the sun and moon in causing the same, and a practical acquaintance with the indications of the barometer; the latter of which he should never lose an opportunity of studying, as being the most efficient and trustworthy guide a sailor can have.

The phenomena of the tides I will briefly treat of:—there are several abstruse works and papers written upon this subject, amongst which may be mentioned those by Sir John Lubbock and the Rev. Dr. Whewell in the "Philosophical Transactions," 1838; the "Annuaire des Marèes," for 1839; "A Report of Observations made on the Tides in the Irish Sea, &c.," by Capt. F. W. Beechey, R.N.; "Philosophical Transactions," 1848; and also in the "Nautical Magazine," 1849, p. 70; "On the Law of the Tides of the Coasts of Ireland," by G. B. Airy, Esq., Astronomer-Royal; "Philosophical Transactions," 1845; and which the yachtsman may study with advantage when he becomes somewhat advanced in his career. For the present I shall merely set forth such introductory matter as may prove useful towards acquiring a preparatory knowledge of the subject, extracted from the best known works that afford such information.

The moon is a satellite or attendant upon the earth, just as the satellites of Jupiter, Saturn, or Herschel, are attendants on these planets respectively. Its diameter is about 2,160 miles, or rather more than one-fourth of the earth's diameter. The moon revolves round the earth in 27d. 7h. 43m. 11½s., but as the earth is, in the meanwhile, proceeding

in its orbit round the sun, the moon takes a little longer time to come into the same position with respect to the sun. From one new moon or one full moon, to another, therefore the time is 29d. 12h. 44m. 8s. The moon at its mean distance is about 240,000 miles from the earth. The distance of the moon from the earth is only about half the distance of the centre of the sun from his circumference, so that if the sun were in the same place with the earth, in regard to the moon, he would fill up the whole distance between the earth and the moon, and as much beyond it. Yet the face of the moon is about the same apparent size with that of the sun. The reason of this is that the sun is 95,000,000 of miles distance, whilst the moon is only 240,000, so that, although the moon's real diameter is only $\frac{1}{400}$ of the real diameter of the sun, their apparent diameters are nearly equal; the diameter of the sun is 888,000, but as the moon is 400 times nearer the earth than the sun, hence the powerful effect she exercises upon the tides in comparison The moon moves round the earth, as the earth does round the sun, in an elliptical orbit, the earth being in one of the foci; the apparent motion of the moon is that of rising in the east and setting in the west, but this is owing to the revolution of the earth upon its axis. The moon's real motion round the earth is from west by south to east.

The various appearances which the moon periodically presents in her revolution round the earth are termed "phases," and arise from the different positions which its opaque mass assumes in relation to the sun and earth. That half of the moon which is turned towards the sun is of course enlightened, while the other half is dark. When the moon is between the sun and the earth its dark side is presented to us, and it is consequently invisible, in this position it is to be called the "new moon." Four days after the time of new moon she has receded 45 degrees from the sun, and a portion of her illuminated surface is seen in the form of a crescent, the cusps or horns, as her pointed ends are called, pointed to the eastward, and slightly inclined to the south. After eight days she has departed 90 degrees from the sun, and shows a bright semi-circular disc, or half moon; she is now said to be in her first quarter. Gradually showing more of her illuminated surface she becomes gibbous (from "Gibbus L. hunch-backed," convex), and about fifteen days after the time of new moon she stands directly opposite the sun, presenting a complete circular disc; she is now called the "full moon," rising when the sun sets, and shining throughout the night. Proceeding on her

course her illumined surface gradually decreases, and as she approaches the sun becomes a second time gibbous, then a half moon in her last quarter, after which she assumes a crescent form, lying more on her back, and, finally completing her orbit, disappears, becoming a new moon again as at first.

Thus two important effects are produced; the first is the light which she affords during the absence of the sun, and when at the full comes to the meridian at midnight, distributing her light equally during the hours of darkness. The second effect produced by the moon on the earth is the tide which she causes in the ocean. The earth and the moon, agreeably to the universal law of gravitation, attract one another; that is, each draws the other towards it with a force proportional to the quantity of matter in each. The consequence of this is, that the waters of the ocean being easily moveable, the moon in passing over the earth, in the earth's diurnal rotation, draws them towards that point which lies nearest to her, and thus creates an accumulation of water round that point, which is called a tide. This tide does not accumulate immediately at the spot where the moon is in the meridian, but follows it at some little distance. One remarkable fact in regard to the tide is, that it occurs twice in every twenty-four hours, and not once only as might have been expected. The explanation given of this phenomenon is, that the moon draws the whole earth towards her, but those parts which are nearer to her more strongly than those which are at a greater distance. The result is that the waters nearest the moon are drawn most strongly towards her, and those that are most remote being drawn least strongly are left behind. The great mass of the earth is drawn away from them, leaving them as an accumulation on that side of the earth which is farthest from the moon. Thus there is a tide following the moon on the side of the earth nearest to her, and another tide following the point on the earth which is at the greatest distance from her.

Tides are also created by the sun, but much less perceptibly, in consequence of his greater distance from the earth. The solar tides are felt chiefly in the effects they produce upon the lunar tides. When the sun and moon are on the "same side" of the earth, which happens at the "new moon," or when they are on "opposite sides," which happens at the "full moon," the attraction of the sun comes to aid both that tide which is nearest the moon, and that which is on the opposide side of the earth. At these seasons, therefore, the tides rise higher, and are

called "spring tides," which occur at the full and change of the moon, or more properly speaking about three days afterwards. But when the moon is at the quadrature, or, in other words, at either of the "half moons," the attraction of the sun crosses that of the moon, and thus, to a certain extent, counteracts it. At these seasons, therefore, the tides do not rise so high, and are called "neap" (low, decrescent) tides; the lowest neap tides are generally four days before the full or change.

Since the sun and moon act with greater force as they are nearer, the effect of each body in raising the tide is greater as its parallax is greater. The highest spring-tides would occur, therefore, in January, about the time of the month when the moon's horizontal parallax is greatest; the further off a celestial body is, the less parallax it will have, and the nearer the more. If the actions of the sun and moon were uninterrupted by obstacles or forces of any other kinds, the tides would be regular, and their calculation certain; but from the unequal depth of the ocean, the barriers presented by islands, continents, &c., which stand across the natural progress of the tides from east to west, they are obliged to make a long circuit, and to flow in various directions; as water always inclines to its level, it will during its passage as a tidal wave, fall to any other point of the compass, to fill up vacancies where it finds them, whence the setting of the tides, and the times of high water are different at different places. The "height" of the tide is the difference between the level of high water and that of low water; the height of the tide in the open ocean is supposed to be very small, and the great heights observable on some shores are evidently due to the shoaling of the water and the narrowing of the channel. Lakes and island seas, such as the Caspian, Mediterranean, and Baltic, have little or no sensible tides, for they are usually so small that the attractive influence of the sun and moon is nearly equal at both extremities, and does not therefore, sensibly affect the water. It is found, in general, that the tide at any particular place is not due to the transit of the moon over its meridian immediately preceding, but to a transit which has occurred some time before. The time that elapses between the transit originating a tide and the appearance of the tide itself is called the "retard," or "age of the tide;" thus the tide on the western coasts of Spain and France is a day and a-half old; at London two days and a-half; on the west coast of Ireland two days; and on the south-west coast one day twenty hours old.

It is, therefore, necessary to discriminate between a tide which may happen after any particular transit and the tide which really "corresponds" to that transit; thus, for example, if the moon passes the meridian at 4h. p.m. to-day, and the high water occurs at 7h. p.m., this tide will not in general be that which "corresponds" to the transit three hours before, but may have its origin several transits back. The transit to which the tide really corresponds is found by examining the observations of the several preceding tides; the highest of which, being due to the united action of the sun and moon, is known to correspond to the moon's transit at 12 o'clock, noon or midnight. The "mean level" of the sea is the middle between the levels of high and low water; heights measured above the sea should be referred to the mean level as the standard or zero, instead of that of either high or low water; it is not, however, to be supposed that the middle point between any two consecutive tides is the mean level; this will be the case only when two tides in succession attain the same high water level, and the same low water level, as at spring tides. When the time of high water at any place is mentioned generally, or either of the terms "establishment of the port, or tide hour," is made use of it, it is commonly understood to mean the apparent time of the first high water that occurs at that place in the afternoon of the day of "full or change."

To know the time of high water at any place, put down the time of the moon's meridian passage for the day, take from page 4 of the month in the "Nautical Almanac," to this add the time of high water in the full or change of the moon at or near the port required, taken from the tide table of the "Nautical Almanac," or any other tide tables. Their sum is the time of high water at the place on the given day at p.m. If this sum exceeds 12h. 24m. subtract 12h. 24m., or 24h. 48m., as the sum may exceed those numbers, and the remainder will be the time of high water "always" at p.m. This rule will give a "rough estimate," but for complete accuracy the yachtsman may furnish himself with the tide tables published annually by the Hydrographic Office. Strong winds will affect the time and height of the tide, but chiefly the former, more especially in rivers and narrow seas. The pressure of the atmosphere also affects the height of the tide, the water being generally higher as the barometer is lower. In some places it is high water on the shore or by the ground, while the tide continues to flow in the stream or offing and, according to the length of time it flows longer in the stream than

on the shore, it is said to flow tide, and such part of tide, allowing six hours to a tide. Thus three hours longer in the offing than on the shore make tide and half tide; an hour and a half longer make tide and quarter tide; three-quarters of an hour longer make tide and half-quarter tide, &c.

A yachtsman should take particular note of localities where this occurs, as he may make slack water or ebb tide along the shore, and so favour a passage, whereas by keeping in the offing he would be encountering the full force of a contrary tide; and *vice versa*, he may make flood in the offing when it is contrary tide along shore. There are many places where eccentric movements of the tide, occasioned by the formation of the land, intervening islands, headlands, narrow channels, straits, &c., giving it different direction and force, may be either taken advantage of or avoided, by bearing in mind the time of high water, whether spring tides or neaps are on, the former of which run much stronger than the latter from their superior height and consequently greater body of water, and also the effect of the wind in raising or retarding the tide.

The force and direction of the wind should be never lost sight of in looking out how tides can be hit off during cruises; a strong wind against a flood or ebb tide near headlands occasions frequently nasty over falls and short heavy seas that are by no means pleasant, and that a few hours at anchor in a convenient stopping place, until the tide slacks or turns favourably, may enable them to be avoided; it is hardly necessary to say that a good knowledge of the tides, and the best methods of working them to advantage adds in no small degree to the pleasure of cruising, and the certainty of making quick and successful passages. There are many localities around our coasts, or as they may be termed "our home cruising grounds," where a yacht might find it exceedingly awkward to be caught in heavy blowing weather with an adverse state of tide; such places as Cape Wrath, Mull of Cantyre, Mull of Galloway, Calf of Man, or Point of Air, Holyhead Race, Tuskar, Cape Clear, Lands' End, Bill of Portland, back of the Isle of Wight, &c., will afford instances; and very many others might be adduced.

To be a good judge of weather prognostics is of great importance to a yachtsman, and to the signs and tokens of the weather, he should at all times give attention; whether prognostics have been handed down by tradition from the remotest antiquity, but modern science has divested

them of much of the mystery of which our forefathers invested them, and enables us to trace cause and effect, and measure atmospheric influences with more certainty and satisfaction than by mere hearsay or supposition. However, there are many weather tokens so plain and simple as need but the most ordinary application of reason to foretel their result, and indeed their very simplicity may oftentimes endanger their being undervalued and neglected.

We have seen the influence the moon exercises with regard to the tides; with respect to her influence with regard to the weather there are many conflicting opinions; from time immemorial changes of the weather have been looked for in connexion with changes of the moon, and human prognostics are regarded by very many well informed persons, as much more to be depended upon than even the indications of the barometer; the table which I here insert makes its annual appearance in almost every Almanac that is published, and the conditions therein set forth have been so often verified, as in a great measure to justify a belief in the moon's influence upon atmospheric changes.

"Fair and Foul Weather Prognosticator."—The following Table and the accompanying remarks are the result of many years actual observation; and will show the observer what kind of weather will probably follow the entrance of the moon into any of her quarters.

| If New Moon—First Quarter—Full Moon or Last Quarter happens. Time of Change. | In Summer. | In Winter. |
|---|---|---|
| Between midnight and 2 in the morn | Fair | Hard frost, unless the wind be S. or W. |
| „ 2 and 4 ditto | Cold, with frequent showers | Snow and Stormy |
| " 4 and 6 ditto | Rain | Rain |
| " 6 and 8 ditto | Wind and Rain | Stormy |
| " 8 and 10 ditto | Changeable | Cold rain, if the wind be W. Snow if E. |
| " 10 and 12 ditto | Frequent Showers | Cold and high wind |
| At 12 o'clock at noon and to 2 p.m. | Very Rainy | Snow or Rain |
| Between 2 and 4 after... | Changeable | Fair and mild |
| " 4 and 6 ditto | Fair | Fair |
| " 6 and 8 ditto | Fair, if the wind N.W. Rainy, if S. or S.W. | Fair & frosty, if N. or N.E. rain or snow, if S. or S.W. |
| " 8 and 10 ditto | Ditto | Ditto |
| " 10 and 12 ditto | Fair | Fair and frosty |

REMARKS.—1. The nearer the time of the Moon's Change, First Quarter, Full, and Last Quarter to "Midnight," the fairer will the weather be during the seven days following. The space for this calculation occupies from ten at night to two next morning. 2. The nearer to "Midday" these phases happen,

the more foul or wet the weather may be expected the next seven days. The space for this calculation occupies from ten in the forenoon to two in the afternoon. 3. The phases happening from four to ten in the afternoon, may be followed by fair weather, but this mostly depends upon the wind. 4. To prognosticate correctly, where the "wind" is concerned, a good vane should be within sight. Dr. Kirwin remarks if a storm arise from the East on or immediately preceding the time of the Spring Equinox, or from any point of the compass near a week after, then, in either of the cases, the succeeding summer is dry, four times out of five; but if a storm arise from the S.W., or W S.W., on or just before the Spring Equinox then the summer following is wet, five times in six.

There is one appearance presented by the lunar body which, philosophy and science to the contrary notwithstanding, indicates a change to storm and rain, that many a hardy sailor has witnessed to his cost.

I have been in many a hard gale, that has been indicated by this ring or halo, round the moon, and have from my own observation, as well as the experiences of others related to me, formed the conclusion that the paler and more cold looking the light of the moon appears, and the more distant the ring, the heavier will be the gale of wind that follows, and generally accompanied by rain; south or south-west winds almost always result, and sometimes south-east; if the latter a regular hurricane prevails. I have also witnessed the appearance of similar rings when the light the moon gave was cheerful and bright, and the ring faint and at a great distance from her; in such cases fair weather and very light breeze followed.

That we have frequent changes from fair to foul at the full or change of the moon, and *vice versa*, is too well known almost to need remarks and it is upon this fact that many who have not entire faith in the moons' meteorological influence, extend their belief so far as to place implicit reliance on such changes being effected by her.

Dr. Lardner, in his "Popular Physics," strongly combats the popular opinion that the moon has any effect upon atmospheric changes; he says—"The imputed influence of the moon upon the weather may be considered as a question of theory or a question of fact. Let us consider, for a moment, the theoretical question. If the moon acts upon our atmosphere by attraction, as she acts upon the waters of the ocean, she will produce 'atmospheric tides.' The greater mobility of air will cause those tides to be formed more rapidly than the water tides, and it may be, perhaps, assumed that they will always be placed, either exactly, or very nearly under the moon. Thus, as there is 'high water,' twice daily,

so would there be 'high air' twice daily, and the times of this air-tide would correspond with the moments of the transit of the moon over the meridian above and below the horizon. The same causes, also, which at new and full moon produce spring tides, and at quarters neap tides, would produce spring and neap atmospheric tides at the same epochs." He goes on to argue that from observations of the barometer this could not be the case, as it would stand higher at the full and change, and lower at the quarters, thus indicating fair and foul weather at precisely opposite periods to the generally received opinion. It may be asked, with some show of reason, has not the great additional body of water that is moved by the moon's influence at full and change somewhat to do in the disturbance of the atmosphere? and that the disturbance is erroneously attributed to the moon; those versed in the sea know that currents will draw wind along with them; rivers falling into the sea bring strong breezes along their course sometimes, as yachtsmen have no doubt often experienced.

Again Dr. Lardner says—"But it may be said that although the moon may not affect the atmosphere by her gravitation, yet she may influence it by her light, or by electric or magnetic emanations, or, in fine, by some occult physical causes not yet discovered by astronomers. This is an objection that, from its vagueness and indefiniteness, is difficult to be rebutted by any means which theory can furnish. It is known that the light of the moon concentrated in a point by the most powerful burning lenses, is incapable of producing the slightest sensible effect on the most susceptible thermometer. Neither is it found to produce any effects of an electrical or magnetical kind. It may be assumed generally that the effects commonly imputed to the moon, in producing change of weather at her principal phases, are so contradictory, that it is impossible to imagine any physical causes which could account for them."

Contrary however to Dr. Lardner's reasoning, which it may appear very presumptious to question, we have instances of moon blindness, fish becoming rapidly putrid when exposed to the moon's rays, quadrupeds and human beings affected by lunar influence, and such like occurrences that induce us to waver in opinion as to whether we must ignore the influence of the moon in atmospheric changes. He further goes on to say, "But let us dismiss the theoretical view of the question, and inquire into facts. Has it been found, 'as a matter of fact,' that

the epochs which mark the principal phases of the moon, have been, in the majority of cases, attended with a change of weather? He goes on then as to what may be defined a change of weather, and questions whether any weight can be attached to the opinions of observers who confess themselves prejudiced in favour of lunar influence: as to the existence of prejudice when considering a question of this nature it certainly appears incompatible, in a full and free investigation of natural phenomena, prejudice if allowed to exist, must materially interfere with even an approximate arrival at the truth, that is if it be but idle prejudice. But the admission that prejudice does exist induces the belief that although the majority of cases may not confirm absolutely the opinions held as to the moon's influence on the atmosphere, yet that a sufficiency can be adduced to warrant the existence of a doubt, let it be called prejudice if more agreeable,—presents apparent, and I should think strong reasons, for believing that further investigation may develop physical causes and conditions that have hitherto escaped philosophical research, and is necessary before finally ignoring a belief that has been so long and popularly accepted.

Dr. Lardner, after stating that observations of the barometer tended to upset, both in theory and fact, the supposition that lunar influence had any effect upon the changes of the weather, says—"Although, therefore, it cannot be denied that there exists a certain relation between the barometric column and the lunar phases." And again, "From all that has been stated, it can scarcely be denied that there exists some correspondence between the prevalence of rain and the phases of the moon."

Surely such admissions as these betoken a belief on his part that lunar influence does obtain in the atmosphere, and if the barometer does not indicate changes of the weather, and that the fall of rain is one of them, facts go for nothing. I, for one, would certainly feel inclined to watch narrowly the weather prognostics afforded by the moon's phases, at least until some more conclusive reasoning convinces me, not from either obstinacy or prejudice, but from the feeling that whilst a doubt can exist we are bound to give the benefit of it to that side which has facts to corroborate it.

The general appearance of the sky should not escape the vigilant observation of a yachtsman, and by paying attention to the changes that are of frequent occurrence, he will almost imperceptibly, and in a

short time, be enabled to distinguish favourable from unfavourable symptoms: very simple indications present themselves in the daily and nightly appearance of the heavens that should never be neglected, and which when considered in connection with the fluctuations of the barometer will enable a tolerably accurate judgment to be formed. A careful comparison should be made of the appearance of the sky at different periods of the day and night, the formation of clouds, the direction of the wind, and the state of the tide, whether flood, ebb, high or low water; strong breezes generally spring up on the flood, become moderate at high water, and again steady or variable, or perhaps shift to the opposite point of the compass on the ebb; when it blows strong at north-west, accompanied by rain, and that the clouds break up in that quarter towards high water, a shift of wind to north-west may be anticipated; the wind coming from the east with the rising sun, accompanying him in his course throughout the day, and blowing from the west at night, with a good crimson sunset, is an excellent sign of fine steady weather; but when the wind blows from the west in the morning and backs out throughout the day, accompanied by a cold grey or pale dirty yellow looking sky, plenty of rain, wind, and unsettled weather may be looked for; north-west winds not blowing steadily and veering to west and south-west, with black clouds rising rapidly and in heavy masses indicate severe squalls and dangerous and unsettled weather; a cold grey morning with light winds from the north-west and fitful sunshine, and a hazy appearance in the southern horizon, generally terminates in the afternoon with a gale of southerly or south-west wind accompanied by rain on the evening flood tide; clouds, the edges of which present a hard well defined outline, are bad; a wild scud flying overhead generally foretels heavy north-westers, attended by furious rain squalls. Heavy mists hanging about the tops of mountains or elevated headlands are sure indications of south-west gales and plenty of wet weather. Southerly and south-east winds, blowing fitfully, and accompanied by pale fog or haze, with occasional light showers, generally clear up at noon, and are followed by a fine bright evening and steady north-west winds; a heavy white fog in the morning, accompanied by light easterly winds, with the sun struggling to break out, will frequently change to a bright clear day, with steady easterly breeze, veering with the sun to west and north-west towards evening; but a cold grey fog and light winds in the morning, with a heavy sluggish roll

of the sea from the eastward, betoken a steady easterly gale and clear weather for the afternoon: if, on the clearing away of the fog, heavy clouds be observed of considerable extent and thickness, having their lower edges marked by large protuberances, and their upper surfaces torn and rugged, presenting a peculiar dark greyish appearance, tinged with faint red, and lying low, hail squalls may be looked for; when these approach they present a very threatening appearance, the hail tearing up the sea as though a tremendous squall were ripping up its surface; but they are more alarming in appearance than reality, and as they may be distinguished a long way off by the peculiar misty and frothing line the hail creates beating on the water, accompanied by a hissing noise, timely notice is given of their coming, and as there is not, in general, any very great weight of wind attending them, a yachtsman should never get flurried or alarmed: from their unfrequent occurrence and the threatening aspect they bear, crews are apt to become startled and to let everything go by the run, expecting a sudden and overwhelming squall; but this impression is created by the hissing sound of the hail beating the sea into foam, and as they are not so quick in their movements, or heavy, as wind alone, timely preparation may be made with perfect coolness and confidence. Hard, streaky, long and torn looking clouds, commonly designated "mare's tails," stretched across a cold looking sky, and without much perceptible motion, almost always presage strong, and squally winds from that point of the compass they radiate from; this is generally from west or north-west. If seagulls be observed hanging about cliffs, or along the shore, or striking off inland with a heavy sluggish flight, regular stormy bad weather may be looked for and strong winds may be anticipated fronr that quarter towards which they head; they may be observed flying low and very slowly towards a particular point of the compass, then taking a wide sweep away to leeward and again heading up for the same quarter. Sultry oppressive weather, with occasional hot blasts of wind, is certain to be succeeded by stormy gales, in most instances from north-west to south-west, if the latter sets in heavy rains will follow. The sudden condensation of vapour which causes the fall of heavy rain produces a vacuum in the atmosphere; in general the atmosphere above us consists of a mixture of air, properly so called, and water, either in the state of vapour or in a vesicular state, the nature or origin of which has not yet been clearly ascertained; in either case its sudden con-

version into a liquid state, and consequent precipitation in the form of rain leaves a large space unoccupied, and a corresponding rarefication of the air previously mixed with this vapour ensues; the surrounding air rushing in to fill this space and re-establish the equilibrium of pneumatic pressure produces a great disturbance of the atmosphere, and strong winds follow; therefore, when heavy rain sets in, preparation should at once be made for the gales that are almost certain to result. A moaning or fitful whistling of the wind through the rigging generally indicates wet and wind if there be a dull leaden coloured sky, but if the latter be clear, and moderately clouded, wind only may be anticipated; a clear sky and dry atmosphere foretell northerly and north-west winds, whilst cloudy, greasy, soft weather indicate westerly, south-west, southerly or south-east breezes, the latter particularly if there be a cold misty vapour upon the water. What is called by seamen "a wind dog," which presents the appearance of the butt-end of a rainbow, being seen to windward in the morning, accompanied by dark heavy clouds, is an unerring sign of an approaching gale, and the more brilliant and distinct it is, the worse the coming weather.

Fogs are nothing more than condensed vapour produced from the surface of the sea when the water has a higher temperature than the stratum of air which rests upon it. Fogs are more thick and frequent when the air, besides having a lower temperature than the water, is already saturated with vapour, because in that case all the vapour developed must be immediately condensed, whereas, if the air be not saturated, it will absorb more or less of the vapour which rises from the water. Therefore, heavy fogs generally terminate in a downpour of rain, but in such a case the strong winds that follow rain when the surface of the sea is free from fog are not so certain to result. When a fog is observed coming on and that a vessel is close to the land, compass bearings should be at once taken before it is obscured in order that a course may be determined upon to keep her clear of the land. There is nothing so much to be dreaded at sea as fogs, and yachtsmen cannot be too careful when caught in them, particularly if they should be in the course of steamers, or making the land; easy sail should at once be put on the vessel—just merely what will give steerage way—indeed it is often preferable to heave-to, the more particularly when nearing a port.

Fog signals should always be carefully attended to, and the fog horn,

gun, gong, or bell kept incessently going, for vessels meeting in a fog are upon each other so suddenly that no exercise of skill can avail to escape collision; a careful watch should be constantly kept on deck and no precaution neglected, not only to proclaim the position of the vessel, but to ascertain that of any which may approach; paddle-wheel steamers, in addition to their signals, can be easily distinguished when approaching by the sound of their paddle floats beating the sea; screw steamers are more difficult of detection, they are easy going silent ships, but if the wind is favourable and the look-outs on the alert with their ears, there is a certain beat of the screw that can be heard, and the condenser discharging the condensed steam may also serve as a means of identification; but the usual fog signal of a steamer being the steam whistle, its discordant scream in answer to the fog horn or bell will soon discover the character of the vessel bearing down. The signals used by sailing vessels' crews during a fog are two, viz., fog horns and the ship's bell; if they are on the starboard tack they sound the fog horn, and if on the port tack they strike the ship's bell. When steamers are under canvas "only" they are obliged to use the same signals as sailing vessels.

Whilst on the subject of fog signals it may not be out of place here to mention the night signal lights required to be carried by all vessels. Steamers carry a bright white light at the mast head, showing ten points on either side, or twenty points altogether, that is from right a-head at the stem to two points abaft the beam on each side, and as this is a very powerful light it will be the first seen, its range of illumination being calculated at five miles. A green light on the starboard side, and a red light on the port side, the range of these two lights being calculated at two miles. Sailing vessels, yachts included, carry a green light on the starboard hand, and a red light on the port hand; these lower side lights must be fitted with screens of at least three feet long on the inboard side, so as to prevent them being seen across the bows, and they must each show a uniform and unbroken light over an arc of the horizon of ten points of the compass, viz., from right a-head at the stem to two points abaft the beam. A yachtsman must, therefore, remember that when approaching a steamer if he sees the bright light and a green light he is on her starboard bow, and she is on his starboard hand; she will at the same time observe his green light and know that she is similarly situated with regard to him; vessels in this position may be

either advancing towards each other on parallel lines, crossing each others bows at right angles, going away or crossing each others bows obliquely; one thing is certain they are clear of each other. Should the bright light and red light be seen then the yacht is on the steamer's port bow, and the same observations apply. But should the bright light, the green, and the red be seen altogether, forming a triangle, then the steamer is coming stem on in a direct line, but as she will at the same time observe the yacht's green and red lights together, they will convey a similar warning, and then the usual "rule of the road" with steamers at sea will at once be put in practice, she will put her helm to port, to pass the yacht on the port hand, and the latter must be handled so as to give the steamer a wide berth and pass her also on the port hand. Meeting with sailing vessels their green or red lights will indicate which tack they are approaching on, or if they are running before the wind, the yacht's lights will convey to them which tack she is on, when the usual rules of sailing must be observed, vessels on the port tack giving way to those on the starboard, and those going large giving way to vessels close hauled.

## CHAPTER XXXV.

"When morning rose I sent my mates to bring
Supplies of water from a neighbouring spring,
Whilst I the motion of the winds explored,
Then summoned in my crew and went aboard.
TRANSLATION FROM OVID.

ALTHOUGH science may teach us that many of the weather prognostics so fully relied upon in olden times, are utterly fallacious and not to be depended upon, yet still to look upon them from another point of view, their utility cannot be denied; granted that the moon has not the influence popularly attributed to her in effecting atmospheric changes, and that in many instances the results anticipated at certain seasons, or from peculiar appearances, are not realized; granted also that certain phenomena of the clouds, the water, movements of sea-fowl, fish, &c., cannot be depended upon as unerring guides to the knowledge of coming weather; admitted likewise that many of the "saws" of our forefathers are like nursery rhymes, fitter to amuse children than find a place in the intellect of manhood; yet if we regard them as warnings to arouse attention, as the hands on nature's dial pointing out to us the necessity of being careful; as the monitors to study the more unerring indicators that the discoveries of science has furnished us with, surely then these old time experiences of crude and unlettered minds are not without their uses. I confess that although fully impressed with the immense benefits conferred by science in enabling navigators to measure weather as it were in a delicately poised balance, yet I have a very great respect for the old world signs and tokens, the curt and pithy ("query" pitchy) sayings of our ancient mariners, and based as many of them are upon the observation of natural phenomena, consider them well worthy of attention and study; they may be looked upon as it were the "writing on the wall," that will appeal to us most forcibly from their very simplicity, and from their prominence give us timely notice, at moments when from indifference or carelessness the more certain admonitions of the barometer, sympiesometer, or aneriod might be overlooked, if even thought of.

In addition to the indications I mentioned in my last chapter, there are some others that may prove useful. Land looming very high and clear on the eastern horizon, standing as it were out of the water, houses and trees thereon appearing very distinct, and sometimes with a clear glassy patch beneath, that looks like neither air, earth, or water, but gives them the appearance of floating in the sky, betokens fresh easterly and north-east winds in summer, very often increasing to gales and sometimes with rain, have more generally fine hardy weather; in winter strong and very cold gales may be anticipated, accompanied by sleet and snow showers.

The Aurora Borealis as an electro-magnetic phenomenon is looked upon by many as a precursor to a continuance of bad and stormy weather; this may originate from its often being erroneously confounded with the sheet or blaze lightning that frequently occurs in our latitudes in the summer time, and particularly when the horizon is shrouded with heavy black clouds, following which wet and stormy weather has prevailed. The Aurora is not often seen with us in summer, the spring and autumn are the seasons during which it prevails, and generally after a succession of dry and fine weather; the "Northern Morning," as its name implies, may be therefore looked upon as rather indicating a continuance of fine weather; whereas the sheet lightning, that perchance has been mistaken for it, very frequently precedes sultry weather, to be followed by squally winds and rain showers.

Professor McGauley in his lectures on Natural Philosophy refers to the magnetic effects of electricity upon needles of steel; in some instances demagnetizing them, or reversing their poles; and also that the mariner's compass has been affected by the Aurora Borealis: it is therefore a useful precaution after experiencing weather during which any great electrical disturbance has taken place in the atmosphere, or after the occurrence of an Aurora, to test a yacht's compass. It is almost needless to suggest to yachtsmen the necessity of having more than one mariner's compass on board, although I have known instances where most culpable neglect has been displayed under this head. In fact it will scarcely be credited that I have known instances of small yachts making Channel passages without such a thing as a compass being thought of by their sapient masters, who disclaimed the necessity of such a guide at all. There should always be a standard compass kept below, in such a place and position as to preserve it from all injurious influences; and the compass

in the binnacle on deck should from time to time be compared with it in order to test its accuracy; a good tell-tale compass should likewise be suspended in the sailing master's berth, in order that at night time, when not required on deck during a passage, he may be enabled to see that the proper course is being kept by the helmsman.

There are few yachtsmen now who do not adopt the precaution of having a similar instrument in their own berths, in fact the standard compass referred to is so arranged as to discharge this duty, and thus a double check is preserved upon the man at the helm. There are but few yachtsmen who have not witnessed that extraordinary and beautiful phenomenon—the phosphorescence of the sea; this wonderful appearance of the water at night almost always indicates a run of fine weather, with strong sunshine and light breezes, very often calms! nothing can exceed the magnificent appearance of the ocean upon such occasions, its depths, and the movements of the denizens thereof, being revealed by this bright mysterious looking light, now flashing in broad sheets of many coloured flame, anon flitting fitfully in pale and quivering streaks, to be succeeded by moments when by contrast the water appears of an inky blackness; should a shoal of herrings be encountered the scene presented almost baffles description; myriads of these fish can be seen darting in all directions like arrows of living fire, leaving vivid tracks behind them, like meteors shooting through the sky, whilst ever and again a rush of sparkling flame encompassing more massive bodies denote the passage of some voracious "dolphin," (common dolphin), "bottle nose," or porpoise in pursuit of the flying herrings. On ordinary occasions this peculiar irradiance of the sea is caused by myriads of animalculæ, floating near or upon the surface, which the slightest irritation of the water causes to shine forth in most brilliant scintillations. The acalephæ order of the class radiata comprising the "sea blubber" or "jelly-fish family;" amongst these the beautiful medusæ, the fairy like little beroe, mammaria scintillans, and their almost invisible fry, are the principal agents in this marine illumination; numberless infusoria, crustacea, mollusca, polypus, and annelids contribute their shining powers; and amongst the ascidians those called the pyrosomæ are remarkable for their brilliant phosphoric luminosity. Herr Von Bibra in his narrative of a "Voyage to Chili," states that by the aid of the phosphorescent light emitted by eight of these pyrosomæ he was enabled to read in a perfectly dark cabin; some idea may be formed from this

of what an effect countless millions of such creatures must have floating about on a midnight sea.

It is considered by naturalists who have investigated the subject, that special organs possessed by some of those minute animalculæ, and in others this power spread over their bodies, enable them to display those phosphorescent qualities. In the generality of cases however it is in the external slimy coating of their bodies that this power of shining exists, this coating when thrown off, containing as it does a quantity of cast off cuticles, retains the faculty of gleaming after leaving the little bodies, and even after the death of these animals; so that in addition to the individual powers of illumination possessed by the living animal, their tracks in the water are marked by shining matter undergoing chemical decomposition. I enter into those particulars inasmuch as an opinion is advanced by many that this phosphorescence of the sea is attributable to a magnetic or electric quality of the water, whereas there is abundant grounds for believing that it is exclusively connected with living or dead organic matter; as a proof of this—if phosphorescent water be filtered carefully it will be found to lose the property of shining completely, but if the animals or matter that constitute the residum in the filter be stirred up the illuminating power will be found still to exist in them. Further should a glass vessel be filled with water containing a quantity of mammariæ, points of light corresponding with the position of their bodies will be seen floating about when the glass is shaken, and the brilliancy of the light produced will vary in proportion to the number of mammariæ contained in the water. There is no doubt that the larger marine animals possess the power of glistening and sparkling at night, under it must be supposed certain temperature of water; the parasites which are well known to invest the larger species of fish may have much to do in assisting this power and rendering it more brilliant; they may likewise in swallowing the animalculæ unconsciously add internal aid to this brilliancy; to produce the powerful light seen in the sea during the passage of a shoal of herrings, and which I have before alluded to, this quality of the larger fish assists that of the more minute order, not only in disturbing and developing their phosphorescence but by adding their own to the nocturnal display; the depth of sea that becomes visible during the gambols of such shoals upon a dark night is truly astonishing.

Another faithful prognosticator of weather is the porpoise; whenever these creatures are seen either individually or in a shoal pursuing their

strange undulatory, half bounding course, close along shore, or venturing into harbours, and up rivers, stormy weather may be safely regarded as at hand, no matter what appearances there be to the contrary; their appearance in the open sea is not unfrequently attended by similar consequences, although not so certain as when they betake themselves to shallow water.

The appearance of vast shoals of the larger class of the acalephæ, the disked, ribbed and tubed jelly-fish or medusæ; the giant relatives of the pretty little beroe, mammaria scintillans, &c., foretell gentle breezes and fine summer weather, with nights of phosphorescent splendour; these wonderfully formed and beautiful creatures are well worthy the investigation of yachtsmen: and although of all denizens of the ocean they seem to be almost useless to man, yet the part they fill in the economy of nature is vast, though indirect importance to him; these masses of strange watery looking blubber have been ignorantly supposed to possess the qualities of excellent manure, and immense quantities have been carted from the shore by farmers under the supposition of enriching their lands; and even at the present day on some parts of our coasts the belief is adhered to; it would however take many ship-loads of them to realize a cart-load of fertilizing matter. Their use is of a different though no less important nature; they furnish a luxurious feast to the whale; the basking shark, or bastard sun-fish, and other oil producing inhabitants of the great deep; they likewise provide ample store of food for myriads of crustacea and molluscs, that in due course furnish fattening and dainty meals to the countless shoals of herrings, mackerel, and other fish that abound upon our coasts, so that it will be seen they are not altogether those useless freaks of nature; that many are disposed from want of investigation to designate them.

The play of shoals of herring and mackerel upon the surface of the sea which may be witnessed on fine sunny days, is an indication of a continuance of fine and calm weather; sometimes when the fish are not leaping the presence of a shoal may be discovered by the peculiar glassy or oily appearance of the water immediately over them; and this calm and perfectly smooth patch moving along amidst the gentle ripple caused by a light breeze, betrays their movements to a wary fisherman as surely as the scent of a fox marks his path for the hounds. This oily or slimy exudation ot fish moving in dense masses must doubtless contribute largely to the phospherescence of the sea.

I have heard some quaint old sayings, half rhyme, half prose, and three-quarters reason, amongst venerable mariners and ancient and fish-like men of the sea, not only as regards weather tokens, but also the indications of the barometer, some few of which I have from time to time jotted down, and here insert *valeat quantum, valere potest.*

## WEATHER.

"When the 'sea hog'* jumps,
Look out for your pumps."

"Mare's tails
Leave scanty sails!"

"A rain-bow in the morning
It is a sailor's warning;
But a rain-bow at night
It is a sailor's delight!"

"Red in the East I like the least,
Red in the West I like the best!"

"With a mackerel sky,
Let your light duck fly;
But with mare's tails,
Close reef your sails!"

"When the mist takes to the open sea,
Fair weather, shipmate, it will be;
But when the mist rolls o'er the land,
The rain comes pouring off the sand!"

"Of a 'wind-dog'† to windward beware,
For a sure weather breeder prepare!"

"When the clouds spread like a feather,
Mariner look for fair good weather!"

"North—stormy, stormy and bold,
East—steady—frost and cold;
South—rain—with troubled sea,
West—squalls, and helm's a-lee!"

"When the lofty hills the mist doth bear,
Let the mariner then for storms prepare."

## THE BAROMETER.

"When the glass falls low
Prepare for a blow;
When the glass rises high
Let the light duck fly!"

* Porpoise.

† An appearance like the butt end of rainbow.

"Barometer high—heave short and away,
Barometer low—let you 'mudhook'* stay;
Barometer shifting—reef tackles prepare,
Barometer steady—set sails without fear."

"At sea with a low and falling glass,
The green hand sleeps like a careless ass;
But only when it is high and rising,
Will slumber trouble a careful wise one."

"Lead, log, look-out, and be steady,
Keep an eye on the glass, and for changes be ready!"

Though the weather be fine, and the breeze blow fair,
Sudden changes oft come to pass;
Let not security lull prudent care,
But watch well the range of the glass!"

"When rise begins, after low,
Squalls expect, and a clear blow."

"First rise, after low,
Indicates a stronger blow."

"Long foretold, long last;
Short warning—soon past."

"The hollow winds begin to blow,
The clouds look black, the glass is low;
Last night the sun went pale to bed,
The moon in halo's hid her head.
Look out, my lads! a wicked gale,
With heavy rain, will soon assail."

In addition to the weather signs I have mentioned in my previous chapter, many collected from personal observation, and others from those whose experience enabled them to form correct views; and as I think everything bearing upon a subject of such importance to yachtsmen, should be collected together as quick as possible, I here introduce some observations made by the late Admiral Fitzroy, a high authority on such matters, on the more marked signs, considered by him to be useful.

"Whether clear or cloudy, a rosy sky at sunset presages fine weather; a red sky in the morning bad weather, or much wind—if not rain; a grey sky in the morning fine weather; a high dawn, wind; a low dawn, fair weather.

"Soft-looking or delicate clouds foretell fine weather, with moderate or light breezes; hard edged oily-looking clouds, wind. A dark gloomy blue sky is windy; but a light, bright blue sky indicates fine weather.

* The Anchor.

"Generally the 'softer' clouds look the less wind, but perhaps the more rain may be expected ;– and the harder and more 'greasy,' rolled, tufted, or ragged, the stronger the coming wind will prove.

"Also, a bright yellow sky at sunset presages wind; a pale yellow, wet; and thus by the prevalence of red, yellow, or grey tints, the coming weather may be foretold very nearly; indeed, if aided by instruments, almost exactly. Indications of weather, afforded by colours, seem to deserve more critical study than has been often given to the subject. Why a rosy hue at sunset, or a grey neutral tint at that time, should presage the reverse of their indications at sunrise; why bright yellow should foretell wind at either time, and pale yellow, wet; why clouds seems soft like water colour, or hard edged, like oil paint, or Indian ink on an oily plate; and why such appearances are infallible signs—are yet to be shown satisfactorily to practical men.

"Small inky-looking clouds foretell rain; a light scud, driving across heavy clouds, presage wind and rain; but if alone, wind only. High upper clouds crossing the sun, moon, or stars in a direction different from that of the lower clouds, or wind then blowing, foretell a change of wind; beyond tropical latitudes, in the trade winds of the tropics, there is usually a counter current of air, with light clouds, which does not indicate any approaching change. In middle latitudes such upper currents are not so evident, except before a change of weather.

"After fine clear weather the first signs of change in the sky are usually small, curly, streaked, or spotted clouds, followed by an overcasting of vapour, that grows into cloudiness. This murky appearance, more or less oily or watery, as wind or rain will most prevail is a sure sign. The higher and more distant the clouds seem to be, the more gradual, but extensive, the coming change of weather will prove.

"Generally speaking, natural, quiet, delicate tints or colours, with soft, undefined forms of clouds, foretell fine weather; but gaudy or unusual lines, with hard definite outlines, presage rain and wind.

"Misty clouds, forming or hanging on heights, show wind and rain coming, if they remain or descend; if they rise or disperse, the weather will improve or become fine.

"When sea-birds fly out early, and far to seaward, moderate winds and fair weather may be anticipated. When they hang about the land, or over it, sometimes flying inland, stormy weather and strong winds may be expected. As many creatures besides birds are affected by the

approach of rain or wind, such indications should not be slighted by the observer of weather.

"There are other signs of a coming change in the weather, known less generally than may be desirable, and, therefore, worthy of notice—viz., when birds of long flight, such as swallows and others, hang about home and fly low, rain or wind may be expected; also when animals seek sheltered places, instead of spreading out over their usual range; when pigs carry straw to their sties; and when smoke from chimnies does not ascend readily, that is, straight upwards, as during a calm, an unfavourable change may be looked for.

"Dew is an indication of fine weather; so is fog.* Neither of these two formations occur under an overcast sky, or when there is much wind. One sees the fog occasionally rolled away, as it were, by wind—but not formed while it is blowing."

"When the rain comes before the wind,
Look out, and well your topsails mind;
But when the wind comes before the rain,
Then hoist your topsails up again."

NOTE.—I must beg here very respectfully to dissent from the gallant Admiral's observations with regard to fog not being formed during much wind, inasmuch as I have on more than one occasion witnessed a very respectable fog get up, with a good steady average breeze blowing, and with dark clouds on the horizon previously.

"Remarkable clearness of atmosphere near the horizon; distant objects, such as hills, unusually visible, or raised by reflection; and what is called 'a good hearing day,' may be mentioned among signs of wet, if not wind, to be expected. More than usual twinkling of the stars, indistinctness or apparent multiplications of the moon's horns, halo's, 'wind-dogs,' and the rainbow, are more or less significant of increasing wind, if not of approaching rain.

"Near land, in sheltered harbours, in valleys, or over low ground, there is usually a marked diminution of wind during part of the night, and a dispersion of clouds. At such times an eye on an overlooking height may see an extended body of vapour below, which the cooling of night has rendered visible."

Admiral Fitzroy makes some observations relative to squalls and hurricanes, which may be found useful to yachtsmen extending their cruises to other parts of the world.

* Not always.—*P.D.*

"Generally, squalls are preceded, accompanied, or followed by clouds, but the very dangerous 'white squall' of the West Indies, and other regions, is indicated only by a rushing sound, and by white wave crests. 'Descending squalls,' or, as old sailors and whalers call them, 'williwaws,' come slanting downwards off high land, or from upper regions of the atmosphere. They are very dangerous, being often violently strong.

NOTE.—I would remark here that when a yachtsman finds himself in squally regions, or in the vicinity of high lands, where squalls may be anticipated, it is the most prudent plan at once to reduce canvas, but still to keep the vessel under good steerage way, stationing steady hands by the halliards, so that when the vessel is struck heavily, everything may be let go by the run. It is a great mistake not to keep good way upon a vessel, for should she be struck when lying without motion in the water, the chances strongly preponderate that she may be dismasted.

"A squall-cloud that can be seen through, or under, is not likely to bring, or be accompanied by, so much wind as a dark continued cloud extending beyond the horizon. The comparative hardness or softness of these clouds, as foretelling more or less wind or rain, must not be overlooked.

"The expression 'hardening up,' or 'softening,' or looking 'greasy,' are familiar to seamen; and such very sure indications are the appearances so designated, they can hardly be mistaken.

"The rapid or slow rise of a squall-cloud—its more or less disturbed look—that is, whether its body is much agitated, and changing form continually, with broken clouds or scud flying about—or whether the mass of cloud is shapeless and nearly quiet, though floating onwards across the sky, foretells more or less wind accordingly. An officer of the watch, with a good eye for clouds and signs of changing weather, may save his men a great deal of unnecessary exposure, as well as work, besides economising sails, spars, and rigging."

To these practical observations Admiral Fitzroy has added a very concise but sure rule for avoiding the centre or strongest part of a hurricane, cyclone, typhoon, or circling storm:—

"With 'your face towards the wind,' in 'north latitude,' the 'centre,' of the circling or rotatory storm, will be 'square to your right;' in 'south latitude,' square to 'your left.'

"The apparent veering of the wind and the 'approach' or 'retreat'

of the dangerous centre, 'depend' on your 'position' in the circular whirl or sweep.

"Draw a circle—mark the direction of the rotation or circulation by an arrow, with the 'bend towards the left hand' (or 'against' the movement of a watch's hands) in 'north latitude;' but 'towards' the 'right' (or 'with' the movements of the hands of a watch) if in 'south latitude.' The 'direction' of the wind and the 'bearing' of the 'centre' show your position in the meteor, for such it is, though perhaps hundreds of miles in diameter, and the veering of the wind, or the contrary, and its change of strength, will show how the meteor is moving bodily over a region of the world, like a huge solid wheel revolving on its side, or inclined at a certain angle with the horizontal plane.

"If the observer be stationary in north latitude, and the centre pass on his 'polar' side, he will experience a change of wind from 'southward' by the 'west' towards 'north;' but if it pass between him and the equator, the change will be from 'southward' by the 'east' towards 'north;' the contrary will be the case if in 'south' latitude, as his place in circles sketched will show more clearly than words. The roughest sketch, or diagram, indicating the various directions of wind, and the course of the meteor's centre, will show more plainly than descriptions, which must necessarily vary with each case, and are tedious."

As many of our yachtsmen now extend their voyages to all parts of the world, a few remarks extracted from Mr. W. R. Birt's "Law of Storms," may not be out of place, in addition to Admiral Fitzroy's:—

"The rotation of the air around the axis of the cyclone producing the hurricane wind is 'always' contrary to, or against, the apparent course of the sun, and as the apparent course of the sun is reversed in the opposite hemispheres, so the rotation of the air in the cyclone is in opposite directions on either side of the equator. A very simple rule is deducible from these beautiful facts. In the northern hemisphere the cyclone rotates in a direction contrary to that in which the hands of a clock move, but in the southern hemisphere the rotation coincides with the movements of the hands.

"This whirling of the air in a cyclone enables us to characterize certain portions of the storm by certain hurricane winds; thus in the northern hemisphere the 'northern' margin of the storm always exhibits an 'easterly' wind, the 'eastern' margin a 'southerly' wind, the

'southern' margin a 'westerly' wind, and the 'western' margin a 'northerly' wind. We shall also further find, upon dividing the storm into quadrants, by diameters drawn from the northern to the southern, and from the eastern to the western margins, that upon the 'northern' semi-diameter, or radius, the wind will be 'east;' on the 'eastern, south;' on the 'southern, west;' and on the 'western, north;' each portion of the cyclone will possess its appropriate wind.

"The relation of the winds to the margins and semi diameters in the 'southern' hemisphere will be exactly the 'reverse' of their relations in the 'northern;' thus it is the 'southern' margin and semi-diameter of a storm, 'south of the equator,' that exhibits an 'easterly' wind; the 'western,' a 'southerly;' the northern,' a 'westerly;' and the 'eastern,' a 'northerly.'

"This arrangement of the winds in a hurricane will conduct us to a very simple rule for determining the position of a vessel in a cyclone, and as a consequence the bearing of the centre of the storm from the ship. From the 'easterly' wind in the northern hemisphere the centre will bear 'south;' or eight points of the compass, 'reckoned in the same direction as the apparent course of the sun,' an 'easterly' wind characterizing the 'northern' margin; from a 'northerly' wind the centre will bear 'east;' from a 'westerly' wind it will bear 'north;' and from a 'southerly' wind 'west.' Thus the direction of the wind 'only' in a revolving storm, will announce to the commander of a vessel two very important points—his exact position in the cyclone, and the bearing of its centre from his ship.

"The same simple and very perspicuous rule holds good in the 'southern' hemisphere. From an 'easterly' wind, the centre of the storm bears 'north,' or eight points of the compass, 'reckoned in the same direction as the apparent course of the sun;' the sun rising in the east, culminating in the north, and setting in the west. From a 'southerly' wind the centre bears 'east;' from a 'westerly, south;' and from a 'northerly, west.' These bearings are precisely the reverse of those in the 'northern hemisphere;' but as the apparent motion of the sun is also 'reversed,' the rule is applicable to both hemispheres. 'That the centre of a revolving storm bears eight points from the direction of the wind at the ship, reckoned with the apparent course of the sun.'

"The feature next in importance to the rotation of a cyclone is its progressive motion, and thus in all ordinary cases is reducible to the

same order and regularity as we have seen characterizing the rotation. Commencing at a point a few degrees north of the line, the cyclone moves bodily forward towards the west; its course is, however, soon directed a little north of west, and as it approaches towards 20° north latitude, its course is more or less N.W.; at 30° north latitude its course for a short time is due north; here it 'recurves,' and afterwards is directed towards the 'north-east.' This course is peculiar to the western portion of the basin of the Northern Atlantic.

"The path which the axis of gyration describes is termed the 'axis line,' and thus divides a cyclone into two 'semi-circles,' the right, or 'starboard' semi-circle, and the left, or 'port' semi-circle; there are consequently three divisions of a storm, each characterized by different phenomena.

"No. 1.—In the 'northern hemisphere' the wind always 'hauls with the sun in the right hand or starboard semi-circle of a rotary storm.'

"No. 2.—'On the axis line a vessel experiences only two winds, one the opposite of the other, with an intervening calm between.'

"No. 3.—'In the left hand, or port semi-circle, the wind always blows against the sun.'"

These rules will be found very valuable. The direction of the wind at the ship will give her position in the storm as referred to the points of the compass, and what is of immense importance, the bearing of the centre from her; the hauling of the wind will announce her position relative to the axis line, and combined with her track through the cyclone will give the direction in which the storm itself is moving; if the wind be found to increase in force "without hauling," the ship is on the axis line, and if "a calm occurs," succeeded by a terrific and violent wind from the "opposite quarter," the vessel has passed through the centre of the storm.

We are here introduced to a rule of very considerable importance in manœuvring a vessel when overtaken by a storm of a revolving character. "In the 'Northern Hemisphere,' if a ship receives the wind on her 'port' side, her head is directed more or less 'towards' the centre' of the cyclone; but if she receives it on her 'starboard' side, her head is turned 'away' from the centre. These facts readily indicate the means to be adopted either to retire to, or beyond, the margin of the storm, or to draw from the centre when lying-to. If with the ship's head from the centre she receives the wind on the starboard side, then in lying to or

drawing from the centre she must be trimmed on the 'starboard tack.' The reverse of this takes place in the 'Southern Hemisphere;' a vessel sailing 'out of' the gale receives the wind on her 'port' side, and must therefore be trimmed on the 'port tack.'"

Having thus touched upon the principal characteristics of the rotatory storms experienced in the Atlantic and Southern oceans, I shall mention some of the phenomena which indicate their approach, selected from the best authorities:—

"While the atmosphere 'within' the cyclone is in so rapid a state of rotation (states Mr. Birt), that the moving air frequently attains a velocity of about one hundred miles an hour, the exterior zone is strikingly characterized by certain meterological appearances, which herald, as it were, the approach of the coming storm. The rapid motion of the air within the whirl, combined the 'sucking in' of the exterior air comparatively at rest, produces an immense condensation of vapour generally seen on the horizon in the direction of the cyclone, as a dense, dark, lofty wall or bank of cloud. As the vessel approaches the storm this bank of cloud appears to advance, and draw down closely upon the ship, so that she becomes involved, and then the clouds present so appalling an appearance, they appear to be so close to the vessel, and so solid in their structure, that a commander may almost fancy he can, from the vessel, put his hand upon them." Captain Methven corroborates this appearance; he says:—"The clouds drew close round the ship, banking in a dense dark wall in a manner almost appalling, and so close and solid-looking, without rain, it seemed as if I might have put my hand upon them."

"There are also other appearances of the weather that are exceedingly significant of the approach and presence of a cyclone. Very frequently, a short time before one of these visitants bursts on the ship, the sky presents a lurid, threatening aspect, the state of the atmosphere being oppressively sultry, the clouds vary in their colour from a deep and angry red to a peculiar heavy olive; in such cases the cyclones have been very destructive. More rarely, every object has been seen tinged with a deep crimson, and it has been ascertained that on such occasions the ships have not been far from the destructive gyrations. Sometimes the sun, moon, and stars shine 'differently;' they may be seen, for example, with remarkable distinctness previous to a revolving gale, and they not unfrequently shine as pale luminaries, having around them

large circles of light, known as haloes; on such occasions the stars look big with burrs about them. The sun, on the approach of a cyclone, has been observed 'pale even as the full moon;' and in a few instances, not only has he been seen as a 'blue' sun, but his rays have tinged all surrounding objects blue. The wind has been heard fitfully moaning and roaring violently, as the ship has neared the destructive hurricane; and on shore, branches of trees and other small bodies have been seen to whirl about in a most peculiar manner. Ships that have passed through the centres of cyclones have mostly recorded a clear sky accompanied by a calm; this clear sky is known as the storm's eye.

"When a vessel approaches so near the cyclone as to experience the effect of the outward gyration, the weather becomes more significant; the proper wind of the hurricane, generally characterized as strong and squally, carries over the vessel portions of the great bank of cloud peculiar to the storm; these portions are torn into rags and shreds, while the bank still marks the locality of the cyclone. From this point a run of two hours towards the centre will involve a ship in an impetuous and terrific hurricane."

In the Blenheim hurricane, in March, 1851, the premonitory symptoms of its approach were heavy squalls and rain, the clouds tending to bank and mass, windy streaks of cloud breaking into loose vapoury masses, the edges rugged, torn into shreds, and loaded with rain, which descended in torrents, and increased with the wind; this cyclone left a tremendous sea in its wake, of a character as if divided into squares, rising in pyramids, and throwing up volumes of broken water and spray, across which swept at intervals long, distinct, and very deep swells, succeeded by immense deep rollers which prevented the vessel keeping her main-deck ports open, or setting much sail, and having scarcely steerage way in consequence of the heavy sea. The width of ocean over which this cyclone swept was estimated at 550 miles. Much lightning was observed during its continuance. The Trafalgar's Log, in the same cyclone, records that it commenced with hard squalls and rain, huge heavy masses of lead-coloured clouds indicated its approach; the sun shone through a dense haze, giving the appearance of a moonlight night, lightning prevailed, and the noise of the wind and sea resembled the roar of a park of artillery; the sea was tremendously heavy, breaking over the ship fore and aft; her foresail, main and foretopsails were blown out of the bolt ropes. The log of the Nemesis

records, in addition to the above mentioned indications, that there was a halo round the moon.

Mr. Birt observes—"The barometer is an invaluable instrument in a cyclone, it announces to the commander his approach to the vicinity of a revolving storm; it advertises him of his plunging into its vortex; it acquaints him with his recess from the centre, and by carefully noticing its indications he may, to a great extent, avoid the disastrous consequences of a hurricane, for the laws of its oscillations in a cyclone are very distinctly marked; on the appearance of an approaching cyclone the atmosphere is generally, especially in certain latitudes, very calm, the air oppressively sultry, and the barometer usually stands very high. Observations appear to indicate that this is mostly, if not always the case, 'around' the storm, so that it is surrounded by a margin, characterized by a 'high barometer' and a hot sultry atmosphere. In the direction of the cyclone the clouds assume the appearance of a dark livid bank, in most cases presenting an appalling and threatening aspect. If a diameter of the cyclone be drawn transverse to the axis line, dividing the starboard and port semi-circles into two equal quadrants, it will exhibit those portions of the storm in which the barometer will fall and rise. While the first half of a storm passes the ship the barometer will fall, and while the succeeding half passes it the barometer will rise. The transverse diameter will also be characterized by a barometer which is proportionally lower, as the centre of the cyclone is approached. In most cases of manœuvring it is desirable to keep just within the verge of the storm; and here the barometer is of signal service, as, by keeping it as high as possible without losing the cyclone winds, the vessel is kept just within the margin. In whatever position the ship may be, the rising of the mercury announces that the first half has passed." There seems to be exceptions to the rule enunciated by Mr. Birt, that the barometer rises after the first half of a cyclone is passed, as the log of the Blythswood, in the same hurricane as that encountered by the Blenheim and Trafalgar, records that she met with the centre of it at noon of the 21st March, the calm lasted about an hour, when the wind, which was at east, commenced again at west. The barometer, which was at 28·0 when the centre reached her, rose two-tenths while the calm lasted, but fell again "below" 28·0 after the recommencement of the hurricane. In contradistinction to Mr. Birt's remarks about the barometer, let us see what Captain Methven says, as

he fully corroborates what I have advanced previously, in advocating the close study of all weather signs as assistants towards arriving at a correct judgment of coming weather in "connection" with the oscillations of the barometer. With the view of directing attention to its importance, we have urged upon commanders, in every work on storms, to attend to the barometer, and this is done so continually as to leave the impression that it is "our right hand" as a guide to the state of the weather. Mr. Piddington says—"The man who watches his barometer watches his ship." It is certainly a most valuable instrument to the navigator; "but I would qualify this remark, and all such expressions as would withdraw an officer's eye from the study of the nature of the weather, by the changing character of the clouds looking on them as injurious so far as they tend in the slightest measure to lead to this. It is very obvious what meteorologists had in view, that the barometer should on no account be neglected, "but they can have no idea to what extent faith has been carried. If the barometer do not fall at 8 p.m. with one man, he is sure of a fine night: unless it falls to the speck left by a cockroach on the tube, "a fancy mark with another," there is no necessity to attend to it. Both dogmas have been devoutly believed, and that too by able men. The barometer, as a general rule, will only corroborate inferences previously formed, beginning to fall after bad weather has set in. I am aware that it sometimes falls in calms and in apparently fine weather; but such are exceptional cases. Fully impressed with its importance I have merely made these remarks, deprecating the idea that any instrument can supersede the judgment, or render of secondary importance the most careful study of external signs.

I have introduced the subject of cyclone or hurricane rotatory storms, in these papers with the most apposite observations I could collect relative to them, in order to draw the attention of yachtsmen particularly towards it; many may no doubt exclaim, "What have rotatory storms to do with 'Yachts and Yachting?' Yachts are not to be found tempting the paths of cyclones and storms!" Should there be such of my readers I would beg to remind them that yachts have made voyages to Iceland, Spitzbergen, Jan Mayen, North America, West Indian Islands, South America, Coast of Africa, round the Horn to Behring's Straits, Cape of Good Hope, and Australia. Our yachts are increasing in size every season, and our yachtsmen are no longer satisfied with

runs from Cowes to Gibralter or Malta, or doing the Bosphorus; they seem resolved to raise the pleasure navy to a high position, and win renown for its members as daring maritime adventurers; bearing this in mind therefore, and that we can find in many of our yacht owners good practical seamen and excellent navigators, with evident indications of a much larger number desirous of becoming so, I think any series of papers treating upon the subject of yachting would be incomplete were not that branch relating to weather extended to every description likely to be met with during a yacht cruise. Even should our adventurous cruisers be confined to a limited number, which according to the present position of yachting, and the evident spirit of progress that animates its supporters, is by no means likely; there are certain peculiarities of weather constantly to be experienced in the seas and channels which are more generally cruised in by our yacht fleets, that bear a striking similarity to the storms to which the great ocean cruising grounds are liable; every yachtsman should make himself acquainted with the laws of storms and variable winds; suppose even he never visited those regions of the ocean where cyclones most do prevail, yet still it will induce such an investigation of the principles, and impress so forcibly on his mind the indications of weather that otherwise he might not have had his attention directed to, as will be found of essential service in facilitating the acquirement of a most important branch of a good practical sailor's qualifications. In fact to a yachtsman it is of the greatest importance and utility to make himself a good judge of weather. Corroborative of the opinion that a knowledge of this subject will be found of service to our home cruising yachtsmen, we find that all the conditions involved in the rotatory storms which visit the Atlantic and Southern Oceans have been complied with in their own immediate latitudes; from inquires carried out by Mr. Milne, whirlwind storms are often to be traced in high northern latitudes. In the storm of February the 28th, 1849, for example, its centre passed in a north-east direction up the Irish Channel and across the south of Scotland; its eastern segment affected severely the south of England, uprooting large tree, and causing wrecks, one of which was an emigrant ship with 160 passengers. Its effects were not so disastrous in Scotland, but its rotatory character was well developed there. At the observatory on the Calton Hill, at Edinburgh, the gale began with the wind at S.S.E., and it veered successively to south, south-west, west, and north-west. On the same day it was

blowing at Kinnaird, Head of Bucchanness, from south-east; at Montrose, S.S.E.; at Edinburgh, south; in Yorkshire, south-west; at Pladda Lighthouse, W.N·W.; at Corswell Lighthouse, north-west; at Skerryson Lighthouse, north; at Islandglass Lighthouse, north-east; and at Pentland Skerries Lighthouse, north. "There could be no doubt, therefore," adds Mr. Milne, "that this was a whirlwind storm, and that the direction of the rotation was from right to left in the northern half of the circle." This quite agrees with the principle of Atlantic cyclones, that the wind hauls with the sun in the right hand or semi-circle of a rotatory storm. It is further stated that "bad weather in England is generally followed by bad weather in Scotland, a fact which follows from the northward advance of storms." Lieut.-Col. Reid, of the Royal Engineers, whose able works on storms are well known, notices a severe Atlantic storm which passed over the British Islands. It first touched the west coast of Ireland on January 6th, 1839, and moved progressively, about E.N.E., over Ireland, the Irish Channel, and Great Britain. It was traced to Gottenburg in Sweden, and this is the same direction taken by many of the storms which have been traced over North America and the Western Atlantic.

It seems, therefore, more than probable that many of the gales with which our shores are visited are neither more nor less than sections of rotatory storms, passing in the usual north-east course of the Atlantic. If we recall to memory our experiences of some of these gales, it will be remembered that the wind blew furiously from the south and east, then was succeeded by a calm, when the wind suddenly flung round to north and west, blew with an equal, and sometimes greater violence, or *vice versa*. Now, if we look at Mercator's chart of the world, and trace where an Atlantic cyclone is generally considered to originate, viz., a few degrees north of the line, then travelling north-west to 30 degrees north, recurving north for a short time and settling them steadily to a north-east course, we shall see that such a path leads the centre, or axis line, right across our Island. Now that we have such an admirable system of meteorogical observation established round our coast, thanks to the exertions of Admiral Fitzroy, and that by the aid of the telegraph every merchant on 'Change can read the fluctuations of the wind, and the direction from which it is blowing at any hour of the day, upon any part of the coast, we may arrive at some more certain conclusion upon this point. The cyclone months in the Northern Atlantic are found

generally to be July, August, September, October, November, and December. In July they are not often found so far north as the track of vessels bound to the United States; but in August and September they are mostly to be apprehended. I cannot close this chapter without directing the yachtsman's attention to the remarks of Captain Methven I have quoted relative to the barometer; of the value of this instrument there cannot be a question, but the proper appreciation of its utility is just the nice point that is so requisite to be understood; to rely implicity upon the barometer, to pin one's faith as it were entirely upon it, to read the words Fair, Set fair, Change, Rain, &c., as if the quicksilver was moved up and down by chronometer works, is the error fallen into on the one side, whilst the almost total disregard of its fluctuations is as equally faulty on the other. The close observation of meteorological phenomena in the first place, and the comparison of these phenomena with the state of the barometric column, will generally give accurate data to draw conclusions from; but, independent of this, there are times when both must be regarded separately, and it is upon such occasions it requires that reliance to be placed in each, which experience gained by long observation will alone satisfy many observers in bestowing.

## CHAPTER XXXVI.

" Suffice it to say that the whole of that day,
And the next and the next they were scudding away,
Quite out of their course, propelled by the force
Of those flatulent folks, known in classical story as
Aquilo, Libs, Notus, Auster, and Boreas,
Driven quite at their mercy 'twixt Guernsey and Jersey,
Till at length they came bump on the rocks and the shallows,
In west longitude one-fifty-seven near St. Maloes."—INGOLDSBY.

HAVING in my two previous chapters treated upon tidal and weather phenomena, selecting such points as I hoped would prove useful in drawing the particular attention of yachtsmen, I will, in the present, offer some observations relative to the instruments used to afford indications of approaching weather. Of these it is almost needless to say the principal is the barometer. Mr. Piddingtion, the well-known and able Meteorologist, propounded the axiom that " The man who watches his barometer watches his ship." The atmosphere which surrounds the earth extends above the surface to nearly the same height in all directions, and presses equally upon every part of the surface, continents, islands, oceans, and seas, with an average pressure of fifteen pounds to the square inch. It is probable that the simple experiment of plunging a glass tube in a vessel of water, sucking the air out of the upper end by the mouth, and observing the water rush in to replace the abstracted air, first drew attention to the subject of atmospheric pressure, and led to the means of weighing a column of air, reaching from the surface of the earth to the top of the atmosphere, with as much ease and accuracy as if it were weighed in a delicately poised balance.

In the experiment of the tube and water, the water ascends when the pressure of the air within the tube diminished by the suction of the mouth becomes less than the pressure of the external air upon the water in the open vessel; this latter pressure preponderating forces the water up in the tube to a certain height, and the weight of this column of water within the tube will exactly equal the excess of the weight of a corresponding column of air, reaching from the surface of the earth to

the top of the atmosphere, over the pressure of whatever amount of air is left in the tube; it follows, therefore, that could a tube be produced to a sufficient length, and were it possible to exhaust this tube by the suction of the mouth, a column of water would ascend in the tube of a weight exactly corresponding to that of a column of air extending from the surface of the earth to the top of the belt of atmosphere that surrounds it. The great experiment which confirmed this theory was made by Pascal, at Rouen, in 1646; a tube was constructed 46ft. in length, and as the suction of the air from it was, at that period, considered impracticable, one end of the tube was closed securely, and the tube filled with water; it was then inverted in a reservoir of water, and being placed in a perpendicular position the stopping was removed from the upper end, when the water subsided in the tube, but, instead of altogether falling into the reservoir, it remained suspended in the tube at a height of 34ft. above the level of the water in the tank, the remaining 12ft. of the tube being empty; it followed, therefore, that this column of water exactly balanced a corresponding column of air extending from the surface of the reservoir to the top of the atmosphere. The observations of ancient philosophers led them to the conclusion that whenever a solid or a liquid was by any means removed, the surrounding air immediately rushed in to fill the space thus deserted, and hence they adopted the physical dogma that "Nature abhorred a vacuum."

Galileo, when consulted upon the sinking of a pump at Florence in the middle of the seventeenth century, the engineers of which could not raise the water in the pipe higher than 32ft., defined Nature's abhorrence of a vacuum to extend to 32ft., but that beyond such a height her dislike was not carried. For some time this problem did not receive any further more satisfactory solution until Torricelli, Galileo's famous pupil, directed his attention to it; he considered that whatever cause sustained a column of water in a pump, the measure of the power thus manifested must be the weight of the column of water sustained, and consequently if another liquid were used, heavier bulk for bulk than water, the same force would sustain a column of that liquid, having less height in proportion as its weight would be greater. He, therefore, selected mercury, as of a proper weight, which, by enabling the column sustained to be much shorter, would render the experiment more manageable. Mercury, bulk for bulk, being 13½ times the weight of water, it followed that if the force imputed to a vacuum could sustain 34ft. of water, it

2 x

would necessarily sustain 13½ times less, or about 30in. of mercury. Torricelli therefore proceeded to make his famous experiment, little thinking what a sensation it would create in the scientific world, or that he was about to define a principle that would lead to the invention of one of the most important meteorological instruments of after ages. He took a glass tube 40in. long, open at one end, and hermetically sealed at the other; this he filled with mercury, and applying his finger to the open end to prevent it escaping, inverted the tube, and plunged it into an open vessel containing a quantity of mercury. On removing his finger, exactly the result he had anticipated occurred, the mercury subsided in the tube until its surface was at a height of 30in. above that of the mercury in the cistern; this was the statement imputed to Galileo, that Nature's abhorrence of a vacuum extended to a height of 32ft., clearly refuted, since in this case it was limited to 30in.

Torricelli's reasoning on the true cause of this phenomenon was, "That the weight of the atmosphere acting upon the surface of the mercury in the cistern, supported the liquid in the tube; but the surface of the liquid in the tube being excluded from contact with the atmosphere, was free from the pressure of its weight; and the column of mercury in the tube being pressed upwards by the weight of the atmosphere pressing upon that in the cistern, and not being pressed downwards by any other force, was in a state of equilibrium." To confirm this, he broke the sealed top of the glass tube, when the air being admitted, the column of mercury immediately fell into the cistern, because the admission of the air upon the top of the column in the tube balanced the pressure on the surface of the cistern, and there being no longer any force to sustain the column in the tube and hold it in equilibrium, it fell to the level of the mercury in the cistern. Further, to confirm the fact that both mercury and water were supported from the same cause, namely, the pressure of the atmosphere, Torricelli placed a certain quantity of water upon the surface of the quicksilver in the cistern; as long as the open end of the tube was held below the quicksilver the column of that in the tube remained at the height of 30in., but upon its being raised to the bottom of the water the column of mercury fell out of the tube and the water rushed in, filling the whole tube, and would of course have risen to a height of 32ft., had it been long enough. Thus was discovered the famous Torricellian tube, which has been the subject of numberless experiments by scientific men; but its principles remain precisely the

same, and are those applied in the construction of the common barometer.

Like all new discoveries tending to disarrange or explode long-established doctrines, Torricelli's was for some time looked upon with an eye of suspicion by scientific men, until the celebrated Pascal put it to a test that for ever set at rest further doubt about it. "If," reasoned he, "it be really the weight of the atmosphere under which we live that supports the column of mercury in Torricelli's tube, we shall find, by transporting this tube upwards in the atmosphere, that in proportion as it leaves below it more and more of the air, and has consequently less and less above it, there will be a less column sustained in the tube, inasmuch as the weight of the air above the tube, which is declared by Torricelli to be the force which sustains it, will be diminished by the increased elevation of the tube."

Torricelli's tube was therefore carried to the top of a lofty mountain, called the Puy-de-dôme, in Auvergne, and the height of the column correctly noted during the ascent. It was found that Torricelli's principle was correct; that the column of mercury in the tube gradually decreased in height as the instrument was carried to a greater elevation. This experiment was repeated upon a high tower in Paris with the same success, establishing the fact beyond further doubt that the column of mercury in the tube, as well as the column of water in common pumps, is sustained neither by suction or by Nature's abhorrence of a vacuum, but simply by the pressure of the atmosphere acting in the one case on the surface of mercury in a cistern, and in the other on the surface of water in a well.

We must remember in considering the principles and construction of the barometer, that our atmosphere is of varying density; air is compressible without limit, and not only compressible, but expansible; the air which surrounds us at the surface of the earth, is the lowest stratum of the atmosphere, and is compressed by the weight of a series of strata above it, which weight, as before stated, averages 15lbs. to the square inch of surface at the earth. If any portion of this air be subjected to double the pressure, it will be contracted to half the bulk, and acquire double the density, or *vice versa*, if relieved of half the pressure, it will expand twice as much in bulk and have half the density; thus the density of the atmosphere is augmented or diminished in proportion to the pressure to which it is subjected; from these properties of the air we find

that as we ascend from stratum to stratum the density becomes less, because the quantity of air decreasing continually, the pressure on each stratum is proportionally decreasing, and the density must become proportionally less. This is the cause of rarefaction of the air, it becoming indefinitely thinner and rarer at great heights, so much so, that in ascending very high mountains, great difficulty is experienced in breathing, and aëronauts record similar facts attending balloon ascents. It is these properties of compression and rarefaction or expansion that generate winds, and it is by measuring the weight of the atmosphere by which we are surrounded, which the barometer enables us to do, that we are enabled to anticipate coming weather, and also to measure the heights of mountains. The name "barometer" is derived from two Greek words, "baros," signifying weight, and "metron," measure. In the construction of this instrument, several precautions are necessary, in order to render them generally useful; for instance, that their indications should be in perfect accordance, so that two barometers brought from different places should exhibit similar altitudes, for if the barometric columns were unequal, the observations made by them when separated, would not admit of comparison, inasmuch as the difference of pressure recorded at different positions would not indicate the true difference of the atmosphere at those places, but might be true to the faulty construction of difference of material in the instruments themselves. The mercury that is used requires great care in its preparation, so that it may be perfectly pure and free from admixture with any other substance; solid impurities, such as dust and dirt, must be effectually got rid of, and this is done by squeezing the mercury through a chamois leather bag, which by not permitting solid particles to pass through its pores, strains the mercury thoroughly; liquid impurities are disengaged by boiling it, which, as they are expelled by evaporation at a much lower temperature, takes place long before it reaches the boiling point. The next step after purifying the mercury is to see that the glass tube for containing it is perfectly clean and free from damp; it must, therefore, be well cleansed by internal friction, and warmed over the flame of a spirit lamp from end to end, so as thoroughly to evaporate any moisture remaining, and to ensure its being perfectly dry.

The filling of the tube with the mercury is the next operation; this is effected with a funnel made for the purpose, and in order to get rid of the air, which despite of all precautions, will more or less be mixed with

the quicksilver, and enter into the tube through the funnel, a column of about ten inches is introduced at first; the tube and mercury contained in it are then heated by means of a spirit lamp until the temperature is raised above that of boiling water, by which means any air or moisture that remains is expanded or evaporated, and the quicksilver being heated to nearly the same temperature as the tube to avoid the danger of cracking the latter, the operation is continued until completed. It is of great importance that no portion of air or any other elactic fluid should be in the tube above the column of mercury, as if there should be, a depressing action will ensue, and the mercury, instead of truly representing the pressure of the atmosphere, will express that pressure less the pressure of the air or other fluid that remains in the tube above the mercury. To ascertain if this be the case, the barometer should be suddenly inclined from a vertical position, when the mercury will strike the top of the tube an audible blow, sharp, distinct, and well defined, if there is no air there; but if the smallest quantity be present the concussion will sound dull or indistinct as off a cushion, and such a barometer must be rejected.

The column of mercury of the barometer has been found to be subject to two species of variations: one is periodical and extremely minute in amount, the other ranges to a greater extent, and comes under the denomination of contingent or accidental; the periodical variations, although so minute, are very complicated. In winter the mercury attains its greatest height at 9h. in the morning; falls from this hour to 3h. P.M., and rises again to another maximum at 9h. in the evening. In summer the greatest height is attained at 8h. A.M., it then falls until 4h. P.M., and rises to a second maximum at 11h. at night; in the spring and autumn these variations take place at intermediate hours. The accidental variations of the barometer are those which take place irrespective of the periodic variations, and being consequent upon sudden or gradual changes in the density of the atmosphere, prognosticate corresponding changes of weather, from whence the barometer receives the designation of weather-glass. The barometer shows whether the air is getting lighter or heavier, or is remaining in the same state; the mercury falls as the air becomes lighter, rises as it becomes heavier, and remains at rest while the air is unchanged in weight; in our latitudes the average change, or rise and fall of the barometric column is nearly 3in., viz., between about 30in. and eight-tenths (30·8), and less than 28in. (28·0) upon extraordinary occasions; but the usual range is from about 30½ (30·5) to

about 29in. (29·0). Near the line, or in equatorial regions, the general range is but a few tenths, except in storms, when it sometimes falls to 27in. (27·0). The barometer falling considerably below its average height is at once an indication that some considerable change is about to take place, and when it falls low, as for instance in our climate, to near 29in. or below it, a gale is certain to follow; indications of approaching changes of weather, and the direction and force of winds, are shown less by the height of mercury in the tube than by its falling or rising; a height of about 30in. (30·0), at the level of the sea, is indicative of fine weather and moderate winds.

As I have endeavoured in these chapters to collect together a general mass of information upon all subjects that bear upon yachting that they may be found useful for reference, and as that of the barometer with the nature of the indications, and the conditions under which certain values may be attached to these indications, should be well studied by yachtsmen. I have culled from the writings of the best known authorities who have compiled rules based upon the combined observation, study, and personal experience of various individuals, further confirmed, and found to be in accordance generally with the results obtained by such eminent philosophers and meteorologists, as Humboldt, Herschel, Sabine, Reid, Fitzroy, Redfield, Espy, and many others.

It is scarcely necessary to suggest to yachtsmen that none but a really good barometer should be allowed on board, and such can be obtained, ranging in price from four guineas up to twenty; the more expensive are generally mounted in elaborately carved cases, but it is not the shell, but the works that should be looked to.

A thermometer on the same frame as the barometer will be found useful, but some prefer having it a separate instrument; it should always be borne in mind that the "barometer," measures the "weight" of the atmosphere, and the "thermometer heat" and "cold," or the "temperature" of the atmosphere. A thermometer having a piece of linen tied round the bulb, "just moistened with water,' and kept so by a thread or wick from a cup is called a wet thermometer; and for ascertaining the dryness or moisture of the air, the simplest and surest method is by comparing it with a dry bulb thermometer, cooled by evaporation as much as the state of the air admits. The wet bulb thermometer will indicate a temperature nearly equal to that of the dry one, when the atmosphere is extremely damp or moist; but when the air is dry and

evaporation proportionate, it will show a much lower temperature. From four to eight degrees of difference is the average of this climate, and as far as twelve or fifteen on extraordinary occasions; seven is considered a healthy average for rooms for living in.

With these three instruments we have the means, therefore, of ascertaining the "weight," the "heat" and "cold," or the temperature, and the "moisture" or "dampness" of the atmosphere," with as much nicety as if we weighed it for each respective condition in a diamond merchant's balance. The atmosphere is lightest when charged with vapour; then it is that the mercury falls, because the air is not so heavy as in its dry state, and consequently it cannot support the column of mercury at so great a height in the tube; and the contrary effect is produced during fair weather. Atmospheric air is specifically heavier than vapour, that is, a given quantity of dry atmospheric air will weigh heavier than the same quantity of unconfined vapour. A barometer should be carefully hung in a yacht's cabin, the gimbals playing easily, and the springs so adjusted that it may always hang in a perfectly vertical position, and be held in check from any sudden shock communicated by the vessel's motion in a disturbed sea. Some barometer arms, or brackets, are made to fold back, so that the instrument may lie close to the bulkhead, as if it was nailed to a wall, when the vessel is at anchor, in order to get it out of the way; but it is much safer, and less liable to disarrangement, if a position be selected where this folding joint can be dispensed with, for it is sure to get hard knocks, and risk the breaking of the tube of a good instrument, and if through inadvertency it be folded back when a yacht is under weigh, or rolls or pitches at her anchors, it will not record truly from the oscillation of the quicksilver.

I will now give a series of rules that meteorological observers have from time to time published as the results of their observations, by which weather may be prognosticated from the fluctuations of the mercury in a barometer tube. From a careful study and comparison of all these, a brief code may be selected by yachtsmen for general guidance both at sea and on shore.

## First Series.

1.—The barometer is highest of all during a long "frost," and it generally rises with a north-east wind, and the reason assigned is, that long frost greatly condenses the air, and the more condensed the air is,

the greater is its pressure on the mercury of the barometer. The north-east wind has the same effect, being both cold and dry, and, therefore, condensed and heavy.

2.—The barometer is lowest of all during a thaw following a long frost, because the air then becomes saturated with vapour, which makes it lighter. The barometer is also very low during south-west winds, because those winds are heavily laden with vapour.

3.—While the barometer stands below thirty the air is sure to be dry or very cold, or both, and no rain may be expected. Very dry air absorbs the moisture, and will not part with it in the form of rain, and very cold air is so much condensed that it has already parted with much of its moisture.

4.—When the barometer stands very low indeed, there will never be much rain, although a fine day will seldom occur. At such times, short heavy showers, with squalls of wind may be expected. When the barometer is very low, the air must be very warm or very moist, or both; but the air will not part with its moisture, but absorb more, until a cold air is introduced; this will condense the vapour—that is, there will be rain, but the barometer will not remain at its extreme depression.

5.—In summer, after long-continued fine weather, the barometer will fall for two or three days before the rain comes. If the fall of the mercury be very sudden, a thunder-storm may be expected.

6.—If the barometer is low during very fine weather, the face of the sky will soon be overcast.

7.—Dark, dense clouds will pass over without rain when the barometer is high; but if low, it will often rain, without any appearance of clouds.

8.—If in frosty weather it begins to snow, the barometer generally rises to thirty, where it remains so long as the snow continues to fall. If after this the weather clears up very severe cold may be expected.

## Second Series.—Fall of the Barometer.

1.—In "very hot" weather the fall of the mercury denotes "thunder." Otherwise, a sudden fall denotes high wind.

2.—In "frosty" weather the fall of the barometer denotes thaw.

3.—If "wet" weather happens soon after the fall of the barometer, expect little of it.

4.—In wet weather, if the barometer falls, expect much wet.

5.—In fair weather, if the barometer falls ... and
expect much wet in a few days, and probably ... the

6.—The barometer sinks lowest of all for ...
next to that for wind—except it be an east or ... wet

... s (on

### RISE OF THE BAROMETER.

... that

1.—In "winter," the rise of the barometer ... w its

2.—In "frosty" weather, the rise of the ... a rise

3.—If fair weather happens soon after ... ward,
pect but little of it. ... iches,

4.—In "wet" weather, if the barometer ... heavy
so," expect continued fine weather ... after"

5.—In "wet" weather, if the ... ermo-
weather will not last long. If the ... back
expect unsettled weather. ... sterly

The barometer rises highest ...
winds it sinks. ... gales

... d rise

... liness

1.—Generally the ...
weather; the falling ... ain;

2.—In sultry weather ...
in winter the rise of ... the
thaw, and its rise ... from

3.—Whatever ...
barometer may ... with
follow immediately ... s the
and, in the ... s wet
will last but a ...

4.—If fair ... snow
continually ... ermo-
and again ... meter
continued ...

5.— ... etimes
change

... s by the
... es south-
... be re-

weather have been of long duration, no perceptible change may take place for some days, and the longer the time which elapses between the fall of the barometer and the commencement of the rain, the longer will be the subsequent continuance of the foul weather.

2.—The preceding rule may be inverted. If the barometer begins to rise slowly and steadily after a long continuance of rainy weather, fair weather will certainly follow; and if several days elapse between the rise of the barometer and its commencement, it will have so much the longer continuance.

3.—If in either of these cases the changes follow promptly upon the motion of the mercury, the new state of the weather will not be of long continuance.

4.—If during two or three days successively the barometer rises slowly and steadily, rain, nevertheless falling constantly, fair weather will certainly follow, and *vice versa*. But if the barometer rises during rain and then fall at the commencement of fair weather, the fair weather will be very transient, and *vice versa*.

5.—A sudden fall of the mercury in spring or autumn is followed by high winds; in summer, and especially during sultry weather, it is followed by a thunder-storm. In winter, a sudden fall after long-continued frost is followed by a change of wind and a thaw and rain; but after a continued frost a rise of the mercury is usually followed by snow.

6.—No rapid fluctuations of the mercury are to be taken as indications of any change of long continuance. It is only the slow, steady, and continuous rise or fall, that is to be attended to as such a prognostic.

7.—A rise of the mercury late in the autumn after a long continuance of wet and windy weather, generally indicates a change of wind towards the north, and approaching frost.

### Fifth Series.—Admiral Fitzroy's Compilation.

If the barometer has been about its ordinary height, say near thirty inches, at the sea level,* and is steady, or rising, while the thermometer falls, and dampness becomes less—north-westerly, northerly, or north-easterly wind, or less wind may be expected.

* It stands lower, about $\frac{1}{10}$ of an inch for each 100 feet of height directly upwards, or virtically, above the sea, where its average height in England is 29·94 inches (at 32°).

On the contrary, if a fall takes place, with a rising thermometer, and increased dampness, wind and rain, or snow, may be expected from the south-eastward, southward, or south-westward.

Exceptions to these rules occur when a north-easterly wind, with wet (rain or snow) is impending, before which the barometer often rises (on account of the coming wind alone), and deceives persons who, from that sign only, expect fair weather. When the barometer is rather below its ordinary height—say near 29½ inches (at the sea level "only"), a rise foretells less wind, or a change in its direction towards the northward, or less wet; but when the mercury has been low, say near 29 inches, the first rising usually precedes and foretells strong wind, at times heavy squalls from the north-westward, northward, or north-eastward, "after" which violence a rising glass foretells improving weather if the thermometer falls. But if the warmth continue probably the wind will back (shift against the sun's course), and more southerly or south-westerly wind will follow.

The most dangerous shifts of wind and the heaviest northerly gales happen after the mercury first rises from a very low point. A rapid rise of the barometer indicates unsettled weather; a slow rise, or steadiness with dryness, shows fair weather.

A considerable and rapid fall is a sign of stormy weather and rain; alternate rising and sinking show very unsettled weather.

The greatest depressions of the barometer are with gales from the south-east, south, or south-west; the greatest elevations with winds from the north-west, north, or north-east.

Although the barometer generally falls with a southerly and rises with a northerly wind, the contrary "sometimes" occurs, in which cases the southerly wind is dry and the weather fine, or the northerly wind is wet and violent.

When the barometer sinks considerably, high wind, rain, or snow will follow:—the wind will be from the northward if the thermometer is low (for the season), from the southward if the thermometer is high.

Sudden falls of the barometer, with a westerly wind, are sometimes followed by violent storms from north-west and north.

If a gale sets in from the east or south-east, and the wind veers by the south, the barometer will continue falling until the wind becomes south-west, when a comparative lull may occur, after which the gale will be re-

newed, and the shifting of the wind towards the north-west will be indicated by a fall of the thermometer as well as a rise of the barometer.

Three things appear to affect the mercury in a barometer:—

1.—The direction of the wind—the north-east wind tending to raise it most—the south-west to lower it most, and wind from points of the compass between them proportionally as they are nearer one or the other extreme point. North-east and south-west may therefore be called the wind's extreme bearings. The range of difference of height of the mercury, due to change of direction "only," from one of these bearings to the other (supposing strength of force and moisture to remain the same), amounts in these latitudes to about half-an-inch (shown by the barometer as read off).

2.—The amount taken by itself of vapour, moisture, wet, rain, or snow, in the wind or current of air (direction and strength remaining the same), seems to cause a change amounting in an extreme case to about half-an-inch.

3.—The strength or force alone of wind from any quarter (moisture and direction being unchanged) is preceded or foretold by a fall or rise, according as the strength will be greater or less, ranging in an extreme case to more than two inches.

Hence, supposing the three causes to act together, in extreme cases the mercury might range from about 31 (30·8) inches to near 27 (27·1) inches, which has happened occasionally.

Generally, however, as the three act much less strongly, and are less in accord, ordinary varieties of weather occur much more frequently than extreme changes.

Another general rule requires attention, which is, that the wind usually veers, shifts, or goes round "with the sun" (righ-handed in northern places, left-handed in the southern parts of the world), and that, when it does not do so, or backs, more wind or bad weather may be expected, instead of improvement.

This rotation of the winds is a direct consequence of the earth's rotation, and currents of air from the polar regions alternating or contending with others from the equator.

The polar currents are cold, dry, and heavy; those from the equatorial parts of the world are warm, moist, and comparatively light. Their alternate or combined action (foretold by the glasses and other signs), solar heat and electricity, cause all the varieties of weather that we experience.

Is is not intended to discourage attention to what is usually called "weather wisdom." On the contrary, every prudent person will combine observation of the elements with such indications as he may obtain from instruments. The more accurately the two sources of fore-knowledge are compared and combined, the more satisfactory will the results prove.

In a barometer the mercury begins to rise occasionally before the conclusion of a gale, sometimes even at its commencement, as the equilibrium of the atmosphere begins to be restored. Although the mercury falls lowest before high winds, it frequently sinks considerably before heavy rain. The barometer falls, but "not always," on the approach of thunder and lightning, or when the atmosphere is highly charged with electricity.* Before and during the earlier part of serene and settled weather the mercury commonly stands high and is stationary.

Instances of fine weather, with a low glass, occur exceptionally, but they are always preludes to a duration of wind or rain, "if not both."

After very warm and calm weather, rain or a storm is likely to occur, or at any time when the atmosphere has been "heated" much above the usual temperature of the season. Allowance should invariably be made for the previous state of the column during some days as well as hours, because its indications may be affected by remote causes or by changes close at hand. Some of these changes may occur at a greater or less distance, influencing neighbouring regions, but not visible to each observer whose barometer feels their effect.

There may be heavy rains or violent winds beyond the horizon, and the view of an observer, by which his instruments may be affected considerably, though no particular change of weather occurs in his immediate locality.

It may be repeated, that the longer a change of wind and weather is foretold by the barometer before it takes place, the longer the presaged weather will last; and, conversely, the shorter the warning, the less time whatever causes the warning, whether wind, or a fall of rain, or rain or snow, will continue.

Sometimes severe weather from an equatorial direction, not lasting

* Thunder-clouds sometimes rise and spread against the wind (lower current). It is probable that there is a meeting, if not a conflict, of air-currents, electricity different, whenever lightning is seen. Their concurrence, when the new one advances from polar regions, does not depress the barometer, except in oscillation, which is very remarkable at the time.

long, may cause no great fall of the barometer, because followed by a duration of wind from polar regions; and at times it may fall considerably with polar winds and fine weather, apparently against these rules, because a "continuance" of equatorial wind is about to follow. By such changes as these one may be misled, and calamity may be the consequence if not thus forewarned.

As the mercurial column rises with increase of pressure of atmosphere, and descends when the pressure diminishes, it indicates a greater or less accumulation of air, which, like other fluid, such as water (when heaped above its average level or reduced below it, from whatever cause), will have a tendency to fall or rise till the general equilibrium is restored. An observer may be under the centre of such accumulation or depression, or he may be more or less distant from it, though within the influence of whatever horizontal movement of air may be caused by such temporary increase or diminution of pressure. Hence the barometer shows, and generally foretells changes of wind; but as complications always occur, and as changes are of greater or less extent, affecting or extending through a wider or more limited area, accompanied by hygrometric and electrical alterations, it is extremely difficult at times to say beforehand what particular change of weather is to be expected, and at what interval of time, although after the event the correspondence of barometric changes with those of the weather can be readily traced. However, notwithstanding occasional perplexity, the general character of weather during the next few days may be predicted by an observer who understands the nature and use of the barometer and thermometer, and has watched them in the few immediate preceding days.

In endeavouring to foretell weather, the general peculiarity should always be remembered, that the barometric column usually stands higher with easterly than it does with westerly winds, and with winds from the polar regions higher than with those from the direction of the equator. Hence the highest columns are observed with north-east winds in northern latitudes, and with south-east in the southern hemisphere.

In the middle latitudes there is an average difference (unreduced or observed height as read off) of about half-an-inch, other things being similar, between the heights of the mercury with north-easterly or south-westerly winds.

The steadier the column, or the more gradually it moves, the more settled in character will the weather be, and conversely. In the tropics, when the barometric column moves contrary to its usual daily motion, inferior weather may be expected (temporarily).

This regular movement, whether tidal, or otherwise connected with the sun's influence, sensible in tropical latitudes, but more or less marked elsewhere, amounts to nearly two-tenths of an inch near the equator, the highest being about nine, and the lowest near three o'clock.

## CHAPTER XXXVII.

"Now in the southern hemisphere the sun,
Though the bright virgin and the scales had run,
And on the ecliptic wheel'd his winding way,
Till fierce scorpion felt his flaming ray."—FALCONER.

THE rules in the last chapter being the principal that have been laid down, by the application of which, and a little time devoted to barometrical observations, a yachtsman will soon become an average meteorologist, of the advantage of which he will soon be convinced. When observing with the barometer on land it must be borne in mind that the column of mercury falls about the tenth of an inch for every hundred feet of elevation above the level of the sea. When placed in circumstances that the depth of water in the rise of the tide is of moment, such as in harbours, that dry at low water, watching to cross a bar entering docks, putting a yacht on the dry slip or gridiron, or launching her, the state of the barometer must not be disregarded, particularly if there is much fluctuation of the mercury; the tides being affected by atmospheric pressure, if there be a considerable rise of the quicksilver there will be a relative depression in the tides, and *vice versa*; the average of either is considered to be about a foot of water to an inch of mercury, but the rise or fall may sometimes range much beyond. It is recommended that observations of the barometer should be made at the hours of 9h. a.m. and 9h. p.m., when the quicksilver stands higher, and at 3h. a.m. and 3h. p.m., when it stands lower than at any other period in the twenty-four hours.

For all ordinary purposes of yachting the marine barometer will be found sufficient, with of course dry and wet blub thermometers; very often these latter are never thought of, but as temperature, and moisture or dryness, have such important effects in connexion with atmospheric changes, the necessity for their use becomes apparent, and when accuracy of result is desirable the indications of the thermometers should always be closely observed in connection with those of the barometer. Many

yachtsmen carry on board, besides the mercurial barometer, both the aneroid and sympiesometer.

The aneroid barometer owes its invention to M. Conté, Professor of the Aërostatical School at Meudon, near Paris. In M. Conté's balloon ascents during the war in Egypt he found the ordinary barometer subject to so much oscillation as to be nearly useless; he therefore devoted his attention to the making of a barometer that, whilst simple in construction, should obviate the inconvenience experienced in the mercurial barometer; for this purpose he adopted a bowl made of iron or copper, with a cover of very thin sheet steel, which, when the bowl become exhausted of air, was kept in its position by a series of internal springs; the air being pumped out of this vacuum vase the atmosphere pressing upon the steel cover caused it to rise and fall accordingly as the pressure varied, and these variations were registered by a hand connected with the steel cover, and moving over a divided dial plate above. This plan, however, did not succeed, the form of the top of the vacuum case being that of an arch was not adapted to the purpose, and changes of temperature exercised such a prejudicial influence upon it that this form of instrument had to be rejected. M. Vidi next took up the subject, and making his vacuum case of a circular shape with flat top and bottom, introduced a gas as a compensating agent for the results of varying temperature. Since that time the aneroid barometer has undergone many modifications and improvements, particularly by Mr. Dent; but the principle involved in its construction is the same, viz., that a vacuum, case of thin metal containing a compensating gas is acted upon by the pressure of the atmosphere, and being connected by means of springs, and a combination of steel and brass bars arranged as levers, gives motion to a hand passing backwards and forwards over a dial divided to represent the state of the weather.

The aneroid is a very beautiful and useful little instrument; but it must be remembered that it is not an independent instrument, for aneroids must be set originally by barometers, and require adjustment from time to time, for which purpose a screw is attached to the back of the external case which, by raising or depressing the principal lever connected with the vacuum box, sets the hand so as to correspond with any particular mercurial barometer. Aneroids are very sensitive, and are not affected by a vessel's motion, and therefore under circumstances when it may be difficult to use the common barometer will be found very

useful; they can be carried anywhere on deck, in the companion slide, or any other convenient place; concussions of the air or vibration of wood, caused by firing guns does not affect them materially; for measuring heights they are portable, convenient, and tolerably accurate, the indicator or hand moving like that of a watch, and recording the height above the level of the sea, or the difference of height between two elevations.

The sympiesometer is also a very useful and highly sensitive instrument, indicating approaching changes more quickly than the barometer: in it hydrogen gas is used, which presses on the oil contained in the tube with a uniform pressure at an equal state of temperature; it is a very delicate instrument and requires careful handling; the top should be always kept uppermost, and it should be placed in such a position that the heat of the sun, fire, or cabin lamp may be avoided; the pressure of the atmosphere acting upon the oil in the tube causes it to be raised or depressed according to density; it is used in conjunction with a thermometer attached to it, the hydrogen gas in a sympiesometer being highly sensitive, any change of temperature is equalised by the sliding scale of the instrument being set to correspond with the height of the mercury in the thermometer; when taking an observation of the sympiesometer, the "pointer" of the sliding scale should be moved on the "inverted" scale of the instrument over which it slides, until it corresponds with the degree of height indicated by the thermometer; when the height of the fluid in the sympiesometer tube, as indicated by the sliding scale, will give the pressure of the atmosphere.

These are the principal weather foretelling instruments used at sea; the mercurial barometer and aneroid may be used independantly of each other, that is, either alone constitutes an effective weather glass; but a sympiesometer may be regarded in the light of a check upon either or both, and, from its sensative nature, drawing attention to the others. Oil sympiesometers are considered to be subject to the influence of lightning or electricity to a greater extent than the other glasses, a fact which should be borne in mind when any great difference becomes evident in comparing them with the common glass or the aneroid.

A yachtsman furnished with these three instruments and the necessary thermometers, will find his meteorological department complete; there are printed forms now published which he should also provide himself with for keeping a daily record of observations, extending over a period

of a week or more; these are ruled in columns for each day, with the dates at the top and a scale corresponding with that of the barometer at the sides, by making a dot upon the paper at the height corresponding with the glass and the hours of observation, with the date at the top of the column, and by connecting these dots across the paper from day to day, the line described will record the movements of the glass for the previous days, and at a glance enable a judgment to be formed of the weather to be expected; the maximum and minimum height for the twenty-four hours may be kept up on these slips if thought necessary; and if observations of the three instruments be recorded on the same slip, where any difference of altitude occurs, it can be denoted by a continuous dark line for the barometer, a dotted line for the aneroid, and a stroke and dot line for the sympiesometer.

In using the mercurial barometer or aneroid for the purpose of measuring heights, the fact of the pressure of the atmosphere diminishing as we ascend affords the means of doing so. Air being elastic, the stratum nearest the earth, and those strata immediately succeeding it, suffer compression from the weight of the superior strata, thus increasing the density of the lower belts of air; but on ascending out of them the quantity of superior strata is gradually diminished, and their compressing force and density becomes proportionately less. If this decrease of density varied according to any fixed or known law, as might probably exist were the temperature of the air found at all elevations the same, much of the difficulty that exists would be overcome; but as the temperature varies in an irregular manner, causing a similar irregularity in the change of the barometric column, it renders the computation of heights by the barometer rather complex. Notwithstanding these difficulties however tables have been constructed, founded upon the principles above stated, by which the difference of level of two places can be approximately determined, the heights of the barometer and thermometer being known. I append one of these tables, as it may be found very useful to yachtsmen in calculating the height of mountains at different places visited by them during their cruises. By observing the height of the barometer at the foot of a mountain or other elevation; and, again, when it is carried to the summit the difference between the number of feet placed in the table opposite the height recorded at the lower station, and the number of feet set against the barometer height at the upper station, will give their difference of height—nearly.

## TABLE.

| Barometer Inches. | Height in Feet. | Barometer Inches. | Height in Feet. | Barometer Inches. | Height in Feet. |
|---|---|---|---|---|---|
| 31·0 | 0 | 26·8 | 3829 | 22·7 | 8201 |
| 30·9 | 85 | 26·7 | 3921 | 22·6 | 8317 |
| 30·8 | 170 | 26·6 | 4025 | 22·5 | 8434 |
| 30·7 | 255 | 26·5 | 4124 | 22·4 | 8551 |
| 30·6 | 341 | 26·4 | 4223 | 22·3 | 8669 |
| 30·5 | 427 | 26·3 | 4323 | 22·2 | 8787 |
| 30·4 | 513 | 26·2 | 4423 | 22·1 | 8906 |
| 30·3 | 600 | 26·1 | 4524 | 22·0 | 9025 |
| 30·2 | 687 | 26·0 | 4625 | 21·9 | 9145 |
| 30·1 | 774 | 25·9 | 4726 | 21·8 | 9266 |
| 30·0 | 862 | 25·8 | 4828 | 21·7 | 9388 |
| 29·9 | 950 | 25·7 | 4930 | 21·6 | 9510 |
| 29·8 | 1038 | 25·6 | 5033 | 21·5 | 9632 |
| 29·7 | 1126 | 25·5 | 5136 | 21·4 | 9755 |
| 29·6 | 1215 | 25·4 | 5240 | 21·3 | 9878 |
| 29·5 | 1304 | 25·3 | 5344 | 21·2 | 10002 |
| 29·4 | 1393 | 25·2 | 5448 | 21·1 | 10127 |
| 29·3 | 1482 | 25·1 | 5553 | 21·0 | 10253 |
| 29·2 | 1572 | 25·0 | 5658 | 20·9 | 10379 |
| 29·1 | 1662 | 24·9 | 5763 | 20·8 | 10506 |
| 29·0 | 1753 | 24·8 | 5869 | 20·7 | 10633 |
| 28·9 | 1844 | 24·7 | 5976 | 20·6 | 10760 |
| 28·8 | 1935 | 24·6 | 6083 | 20·5 | 10889 |
| 28·7 | 2027 | 24·5 | 6190 | 20·4 | 11018 |
| 28·6 | 2119 | 24·4 | 6297 | 20·3 | 11148 |
| 28·5 | 2211 | 24·3 | 6405 | 20·2 | 11278 |
| 28·4 | 2303 | 24·2 | 6514 | 20·1 | 11409 |
| 28·3 | 2396 | 24·1 | 6623 | 20·0 | 11541 |
| 28·2 | 2489 | 24·0 | 6733 | 19·9 | 11673 |
| 28·1 | 2582 | 23·9 | 6843 | 19·8 | 11805 |
| 28·0 | 2675 | 23·8 | 6953 | 19·7 | 11939 |
| 27·9 | 2769 | 23·7 | 7064 | 19·6 | 12074 |
| 27·8 | 2864 | 23·6 | 7175 | 19·5 | 12210 |
| 27·7 | 2959 | 23·5 | 7287 | 19·4 | 12346 |
| 27·6 | 3054 | 23·4 | 7399 | 19·3 | 12483 |
| 27·5 | 3149 | 23·3 | 7512 | 19·2 | 12620 |
| 27·4 | 3245 | 23·2 | 7625 | 19·1 | 12757 |
| 27·3 | 3341 | 23·1 | 7729 | 19·0 | 12894 |
| 27·2 | 3438 | 23·0 | 7854 | 18·9 | 12942 |
| 27·1 | 3535 | 22·9 | 7969 | 18·8 | 13080 |
| 27·0 | 3633 | 22·8 | 8085 | 18·7 | 13219 |
| 26·9 | 3731 | | | | |

It cannot be too forcibly impressed upon yachtsmen, that whilst they adopt the indications afforded by the mercurial barometer, aneroid, or sympiesometer, as reliable guides to the weather that may be anticipated, and as warnings not to be neglected when they prognosticate bad symptoms; yet that natural phenomena, such as I have mentioned in a previous chapter, should not under any circumstances be neglected; by combining observations of both, a much greater degree of certainty

may be attained, than by depending solely on the one, and paying but slight or no attention at all, to the other. Instead of being guided by the ordinary lettering on the faces of barometer plates, which cannot be regarded at best as more than a mere fanciful illustration of the principles involved in the construction of the barometer, it will be found more effectual in theory and practice to connect the fluctuation of the quicksilver with the lettering of the hand of nature in the seas, the clouds and on the land; if certain natural appearances denote a change, and that the weather prognostics afforded by instruments corroborate these appearances, a confidence is induced that leaves no requisite preparation unattended to; but the absence of this confidence will often lead to a hardihood and contempt likely to involve dangerous consesequences. Sudden and dangerous transitions of but very short duration may occur, which a ready appreciation of natural phenomena will prove sufficient warning against, when perhaps an observation of an instrument might not be thought of; whilst on the other hand the slight and gradual fluctuation of instruments will draw attention to the corresponding appearances observable from the study of the elements, and enable a discrimination to be exercised between what is dangerous only in appearance and not in reality.

## CHAPTER XXXVIII.

"Juan embarked, the ship got under weigh,
The wind was fair, the water passing rough,
A devil of a sea rolls in that bay
As I, who have crossed it oft, know well enough."—BYRON.

HAVING in a previous chapter got a vessel fairly underway, I shall now request my reader to accompany me through some of the many manœuvres that circumstances may require to be executed throughout a cruise; upon an accurate knowledge of the methods of performing which so much depends in the acquirement of a sailor's art. As I have often before stated, no amateur sailor can hope to arrive by any royal road at the perfection of a regular thorough-bred professional tar—that is to say, a working hand, who has served a prescribed apprenticeship, slaved through the slush tub and tar bucket, crept in at the hawse pipes as a small boy, and learned the manual labour of a seaman through all the stages, from attending the "doctor" in the galley, up to the conquering triumph of being able to do anything with a rope and spar that becomes a genuine son of salt water to know. But although the extensive knowledge of the manual part of the seaman's art is not easily attainable, yet close observation of the methods of doing things, some practical application in learning not only the most difficult, but the most simple; the determination to master one thing at a time, and not jumble a lot together—a resolution never to be ashamed to seek instruction on however simple a point, even that the smallest boy on board is capable of giving, will almost imperceptibly lead a yachtsman on until there are few matters connected with the details of a yacht that he need be afraid of displaying ignorance in. In fact, these details after all, when investigated, will not be found of that very complicated nature that at the first blush they may appear: the construction and ballasting of hull, proportion of spars, fitting of and work upon rigging, and cutting and making of sails, if taken under their respective heads, and studied quietly in detail will not be found of such an abstruce nature as to involve that serious devotion of time that many think. Leisure from

more important professional or business avocations may be profitably employed in such studies, and as our general body of yachtsmen is composed of a class that is more or less independent, so far as worldly means go, the majority of its members must admit that if their tastes are thoroughly so inclined, they can make plenty of leisure, if they will but so occupy it, to become accomplished yachtsmen; and that too without neglecting any of the more important duties their position in society demands.

It is true that yachting is pursued as an amusement and relaxation from the more important cares of life; and many may say why make a toil of it? So is hunting, driving a drag, shooting, fishing, cricket, steeple chasing, and flat racing; but in any of these latter pursuits a man is thought but little of, nor can he gain any of that, to all of us, agreeable fame that awaits superior excellence, unless he be a really practical good hand. Do not our sporting chronicles point out celebrities after a fashion that denotes more than ordinary application, to say nothing of physical aptitude, in pursuit of this fame? We read of men being superior workmen with hounds; splendid whips and perfectly at home behind their teams! hawk-eyed and unerring marksmen, that, as our American friends say—"cross, down, or up wind, go 'plum-centre; to the mark," be that a trumpeting elephant, tawny lion, or bounding antelope. We have notable Waltons, whose patience rivals that of Job, and whose skill is undeniably proved by the weight and number of their scaly trophies. Have we not sent to the Antipodes champions of the wicket and the bat, to whom have been accorded ovations that a Cæsar might have envied? and have we not too brethren of the silken-jacket, members of the fraternity of silk and scarlet, who have witched the world with noble horsemanship?. Why then should our yachtsmen not occupy their niche in the archives of national sport? We have our tritons, it is true, but not in such force as much to distinguish them from our minnows.

In all the sports I have enumerated, and in which some of the best and bravest spirits of the land have shone pre-eminently, none have lowered their social status by learning how to bridle, saddle, or harness a horse, to bleed and shoe, or, if need demands, even to cleanse and bed him; nothing darkling has come between the wind and their nobility, when, with coat doffed and hammer in hand, they have learned to mould a scear spring, or weld a gun barrel; and white hands or

filbert nails have not suffered any material damage in learning to tie a fly, or form the shapeless willow into the nicely balanced cricket bat. Why, therefore, should the Nelsons of our pleasure navy consider it *infra dig.* to make themselves masters of the simple details of theirs—the most glorious of our national sports, and ignore the knowledge of splicing a rope, bending a sail, or shifting a jib, as either beyond their comprehension, or as more properly the occupation of those they pay to navigate them safely from port to port.

If there is anything in nature more difficult of comprehension—at least to me—it is to know what possible pleasure a man in the prime of his youth, health, and intellect can take in being a mere passenger on board his own vessel; to rise in the morning, to lounge about the deck bound in blue and gold, or perhaps what the publishers—save the mark—might more appropriately designate "half calf!" to enquire yawningly of the steward when breakfast, or dinner, or supper is at hand; to consume numberless cigars; and converse languidly with the skipper on gales of wind, interspersed with querulous enquiries as to what distance it is to the next port, or could not the sun be kept off the quarter-deck? or a harbour be gained before night, and new-laid eggs and cream ensured for the coming morn? is a manner of enjoying life afloat that, like many other habits and customs of civilized countries, is a Gordian knot hard to unravel. No, no, give me the yachtsman that, tiller in hand, can stand on his own quarter-deck every inch the captain as well as the owner; who with one eye on the weather, and the other on his canvas, can make his little ship talk to him in her own silent fashion, and who seems to impart to her movements a life, a living, almost breathing, bounding life, the counterpart of his own gallant and determined spirit, revelling in and enjoying the rapid rush through the foam-capped sea, the wild excitement of the hurtling squall, or the fierce battle with the strong gale through which he can carry her with the confidence and skill of a daring sailor. To be such a yachtsman should all beginners aspire, and a little determination, perseverance, and self-control, will soon realize the position, and ensure that perfect enjoyment of yachting that will not only be personally felt, but shared in by the captain and crew, for unless it be one of those lazy long-shore loafers that sometimes attain the dignity, there is no genuine yacht skipper, or indeed really good sailor crew, that will not take a pride and pleasure in serving under an owner who enters heart and soul into the

spirit of the sport, and proves himself, as it were, worthy of their pet designation—"a regular sea-dog!"

Well, kind reader, you will say I have become sadly digressive in my recent chapters, bounding off at a tangent from getting a yacht underway to barometers, and animalcules, and phosphoresence of the sea, and then into a homily about the enjoyment of yachting. Now, however, that this *Cacoethan Scribendian* squall, through which you have had to scud, in such a heavy sea of ink and reefs of steel nibs, has moderated, we will haul by the wind if you please, and away to sea again. Previous, however, to putting the helm down I must premise that my lucubrations are meant, not to instruct those who have already won their laurels on the deep, which would be presumption indeed, but with the hope of arousing emulation amongst our younger yachtsmen, and drawing their attention to such details of handling and yachting seamanship as it is necessary for them to make themselves masters of, and which I am assured they will feel little difficulty in largely improving upon.

I left the good ship underway with a favourable wind, under all plain working canvas with topsails set and all sheets trimmed to a nicety, laying her course a good clean "full and bye." This expression "full and bye" needs, perhaps, a little explanation so as to divest it of its strictly technical character and show its application. When the wind becomes narrow, or just what will allow a vessel to be steered for her port of destination, she is then close hauled or bye the wind, and as under all circumstances a quick passage is desirable when bound from one port to another, every advantage must be taken to force her through the water at the utmost rate of speed, therefore the sails must be kept full—that is, that the utmost effect of the wind must be thrown into them so as to keep her going at top speed, whilst at the same time she is going as close to the wind as possible, and steered upon that course which will bring her in the shortest time to harbour, "clean full and bye," therefore, means that the sails are exercising their greatest influence in propelling her, whilst at the same time she is kept as close to the wind as possible. One of the greatest beauties of a fore-and-aft rigged vessel is this property of lying closer to the wind than any other vessel that is square-rigged, and of a cutter especially. So far as present experience goes the cutter rig possesses this advantage in a pre-eminent degree over every other. Next may be classed the yawl or dandy rig, and then the schooner.

Instances there have been of schooners distinguishing themselves against cutters, amongst which the names of the America, Alarm, Wildfire, and Violet may be mentioned, but these are of rare occurrence, and under special circumstances that does not admit of even general equality much less a prospect of eventual superiority, although we have amongst us many able yachtsmen of the present day who hold that it is practicable to construct a schooner to work under three sails that shall prove herself equal to any cutter close hauled; this, however, remains for future experiment either to confirm or refute. If I may be allowed to offer an opinion, I think the nearest approach will be found in the yawl rig, which has not heretofore been so fully tested as it might have been; doubtless in a heavy sea and with a strong wind a fast and powerful schooner under three well-cut and flat standing sails would give a cutter all her work to do by the wind, but in such a case any superiority would be traceable as much or more to the fact of the cutter being overpowered by the weight of her boom than to any certain advantage in the special disposition of the schooner's sails. For the present, however, it is enough to the purpose to say that in moderately smooth water and a fresh breeze the cutter rig has maintained its superiority over all others.

In steering a vessel close hauled much depends upon the helmsman, and not a little upon his knowledge of the peculiarities of the vessel he is steering; it may appear somewhat strange to the uninitiated or inexperienced to ascribe peculiarities such as might be supposed to characterize living creatures to inanimate structures of wood or iron, but it is nevertheless as true as it is strange that vessels have their peculiarities of, I was going to say, temper, but probably progression may be more applicable, in as great a degree as the most capricious biped or quadruped that ever travelled over land or water. In the majority of instances careful observation can trace these to some distinctive feature in the form of the hull, in the distribution of weights on board, the effect of certain sails, or peculiar circumstances of sea and wind affecting some one of these; and, again, there are some that set investigation upon the rack, and though no doubt traceable, are yet so puzzling as to impress many of our sailor Jacks with the settled notion "that there is no knowing what salt water likes."

To enter into a detail of many of these peculiarities would occupy many chapters to themselves, suffice it to say that they are well known

amongst sailors, and even many with a moderate experience of the sea, to exist, and, therefore, to fortify my assertion that it requires a helmsman to know his vessel well in order to work her to the utmost possible advantage, I mention their existence. There are some broad rules for steering by the wind that will be found useful in general application, a helmsman must bear in mind the fact that a vessel which takes a hard weather helm, and thereby carries her rudder at a considerable angle with the line of the keel, cannot be sailing to the best advantage, inasmuch as there is a struggle going on between the sails and the rudder, the sails to force her up into the wind's eye, and the rudder to keep her away upon her course, and between the two there is a loss of speed. This very often occurs from carrying too little head sail; a small jib may have been set instead of the ordinary working jib suitable to a whole mainsail, or the bowsprit may be reefed, and consequently the jib not set properly; the foresail also may have a reef in it, and with these reduced head sails, if the whole mainsail be carried, the probability is the vessel becomes what is called "wind greedy," or as some say "gripes," or perhaps, to speak more grammatically, "grips the wind:" that is to say, the balance of sails is destroyed and the preponderence of effect of the after sail (*i.e.*, the mainsail) forces her into the wind, which the surface of head sail (*i.e.*, jib and foresail) is insufficient to counteract, and the rudder is then brought into play with the injurious effect of too much weather helm; if there is a heavy head sea to be encountered and that a small jib and reefed bowsprit must necessarily be carried, the whole foresail may still enable her to lay her course without too great a pressure on the helm, but as the foresail is the most pressing sail in the cutter and the one which, if hauled down or reefed during a strong wind, relieves her the quickest and the most effectually. This proper balance of sails is most essential to the good performance of a vessel close-hauled, and therefore deserves the close attention of a young yachtsman.

The proper trimming of the sheets is another point that requires looking after, so that the action of the sails may be combined as if they formed one large one; if the jib is lifting and the foresail standing with the mainsail, the jib sheet requires hauling aft, or the power of that sail is inefficiently exerted, or entirely lost to the vessel; if the foresail is lifting, the fore sheet requires trimming aft, or a similar result must ensue; and if the luff of the mainsail, or that part of it next the mast,

is all in a bag, and that the foresail and jib are doing their duty, then the main sheet is too far off and requires to be hauled aft. Where a vessel is very sharp and has a long and fine entrance, and that the fore upper body is not flared out above the water to give room on the forecastle; but on the contrary, the bow is carried up fine, then the deck becomes so narrowed as not to give proper spread for the jib sheets. Under such circumstances the sheet holes should be placed well aft and the jibs cut with a high clew. Two evils are likely to result from inattention to this; if the jib sheets are rove in the holes as placed in an ordinarily roomy vessel aloft, then the jib becomes pinned in much too flat, and instead of proving of benefit to the vessel acts as if the sheet was to windward, and if sheets are rove aft, and that the clew of the sail is not rounded up, then the angle the sheet makes with the jib lifts the after leech, and half the sail is all in a bag and becomes useless.

A wide deck will produce a similarly injurious effect upon a foresail, for if the sheets are not led sufficiently aft the sail will not set at a corresponding angle with the jib and mainsail. When the two latter sails are doing their duty, and no matter how flat aft the fore sheets may be trimmed, the sail will be all shaking whilst the others are full, and the tiller will again be brought into requisition with injurious effect to keep her out of the wind. The helmsman will soon ascertain that such defects exist in the trim of a sail when steering a vessel by the wind, but as these may be, and often are, attributed to the faulty trimming of the sails and not to their proper causes, namely, the faulty leading of the sheets, I mention them in connection with the subject of steering a vessel when close hauled to show that faults of fitting sails and gear may contribute quite as much in causing the bad performance of a vessel, as any neglect of the proper setting of canvas.

Some men think that they cannot get their sails trimmed too flat by means of the sheets, and that when all are hauled aft as taut as an iron bar, then a vessel must do her best by the wind; this, however, is a mistake, by such means a vessel may be bound up with pinned-in sails, so that although looking up very close indeed, yet she has no life in her and is not going through the water, in fact, for all practical purposes, she might just as well be hove-to. There must be a certain freedom accorded to the sails to impart life to the vessel, and the more especially if there is any sea on, for if not that harmony of motion, that sort of "give and take" which is so necessary, will be destroyed, and the sails

instead of wooing the wind to fill them, will beat it out of them by a too sudden re-action, and a great portion of the propelling power is lost. When the sails are properly set and balanced by the wind, if the vessel is in good trim she should take but little helm, that little should be a weather one—in fact she should almost steer herself; but a slight weather pressure is always to be preferred, as it ensures her being in perfect command and obedient to her rudder, and if a sudden squall strikes her she can be luffed into the wind on the instant to meet it and enable her to be laid to comfortably should it become necessary to reduce canvas. A vessel that takes lee helm must be eminently faulty in some particular aspect, and is absolutely dangerous in squally weather, as when struck heavily she will not answer her helm with sufficient promptitude to enable the necessary precautions to be taken, and the weight of wind pressing on her sails will pin her down in the water on her beam ends, when her way will become so deadened that unless the mast goes, or is cut away, her sails cannot come down, even were the halliards let go, to relieve her, and as in the hurry and confusion of such a moment there is but scanty time left to cast off the sheets, a capsize may be fairly anticipated.

I have touched upon the aforesaid topics before, but I add some few observations in recapitulating them, with a view still more forcibly to impress them upon the young yachtsman's attention.

We have so far proceeded with the wind in a measure favourable to a passage, as enabling the yacht to lie her course: but now, my yachting friend, we shall imagine a change to come over, not only the spirit of your dream, but the face of the sea;—the wind veers more and breaks off your vessel from her course, until at length you find that to reach your port you will have to beat dead to windward; this will add generally about a half more than the direct distance to the length of the passage, from that point where the wind became unfavourable, this sometimes may be more or less, according to whether the vessel holds, or as is sometimes said, "hangs," a good wind, and also as to whether the tide may effect her in a way that cannot be guarded against, as for instance if it be flowing with the wind, good steersmanship, I need hardly say, has likewise considerable effect either in lengthening or shortening the road. You will, therefore, in the first instance have a look at your chart and see how the tides will act on the ebb and flow, and if by a little generalship you can make them bear their part in shoving the little

ship to wind, so much the better; for example, we will suppose that your course is due north, and that the flood tide runs east and ebb west; and here I must for a moment digress to draw your attention to a point connected with wind and tide which must not be allowed to escape your observation. When we say the wind is north we mean it blows from the north, but when we say there is a northerly tide we mean that it runs or sets to the north.

Well, your course being north and against a northerly wind, you find that the tide is at the period of half flood, and that it has three more hours to run to the eastward; it is evident that if this tide sets against the broadside of your vessel that it will carry her away bodily before it, and, combined with the wind, force her to leeward of her port until such time as the ebb tide made, flowing to the westward. This would occur under such circumstances were the vessel laid on the port tack, but seeing this by inspection of your chart, you lay her on the starboard tack, and as any sort of a weatherly craft ought to lie within four points of the wind, you thus get the benefit of the power of the tide on the lee bow, which has the effect of heaving the vessel bodily to windward, thus assisting you to reach the haven you desire. This is technically termed underbowing the tide, and the vessel may be kept on this tack until the tide is done flowing, or for three hours. The moment the ebb tide makes then the vessel should be hove about on the port tack, when she will have the flow of water again on the lee bow for six hours, but it may not be desirable to keep her all that time on the same tack, as should a shift of wind occur she might be hove down too far to leeward, therefore a medium course is advisable, just taking advantage of the first four hours of either flow or ebb, and working a much less time on the lee-going tide, which will preserve the line of bearing of the desired harbour.

Having thus endeavoured to show the advantage that may be gained by what is called "Working the Tides," I shall now beg of you to make yourself master of the best method of tacking a fore-and-after. In long stretches, or what is more generally understood amongst fore-and-aft sailors, "making long legs to windward," perhaps the very nice handling of a yacht in tacking may not be regarded as so essential as in working in narrow waters; at least on a broad view of the question, where there is plenty of sea room to go and come upon, it does not strike one as of such importance; however, it should be borne in mind that when an

advantage of a foot or two is looked upon with the utmost anxiety in sailing up a confined channel directly against wind, several lengths of the vessel herself in open water ought not heedlessly to be thrown away, and the best proof we have of the importance of attending to this may be found in our yacht races, where matches are now won by seconds, and where a single error in tacking ship may involve the loss of an otherwise well and hard sailed race.

## CHAPTER XXXIX.

"The wind blew fresh again, as it grew late,
A squall came on, and while some things broke loose,
A gust, which all descriptive power transcends,
Laid with one blast the ship on her beam ends."—BYRON.

IN tacking a vessel, the operation seems so simple as almost to render any observations on the method of performing it unnecessary; nevertheless, my young yachting friend, I will endeavour to show you that there is a right and a wrong way of doing so, and that under various circumstances different methods may be employed with corresponding advantage. You will perhaps exclaim, "Pooh! I have seen it done so often, I can't make a mistake,—why it is only putting the helm down, and round the vessel comes!" Very true, that is the simple *modus operandi* explained in a very few words; but just take the tiller for a moment, and try a tack or two—that's it! Now then, you have her in irons—that is, she will neither pay off on the other tack, nor fill again on the one you had her on, and perhaps you will be good enough to explain how this occurred, as you seem to understand how a vessel should be tacked very clearly. You cannot say! Well, then, I shall endeavour to show you how this mishap occurred,—when you took the helm in hand you steered the vessel very fine, that is, too close to the wind, and then putting it down suddenly, and hard over at the same time to her very rail, she having but little way from the fine steering, lost it altogether just before coming fairly head to wind, this you could feel by the tiller ceasing to press against your hand, and then having a tendency to remain over against the rail as she commenced to make a stern board, this is, to gather way astern. So now to get out of the scrape keep the helm down, and as the wind is light, order the fore or jib sheet to be hauled a-weather to help her, and her head will pay off on the original tack she was on,—say the port tack, the tiller being kept to starboard, the rudder will be over to port at an angle with her keel, and when she begins to go astern, her stern will be forced up to the wind by the action of the water against the back of the rudder, and her

bow falling off assisted by the head sails, her mainsail will again become filled, then trim aft the head sails, right the helm, and away she goes again.

Now, Mr. Yachtsman, this next attempt must not end in failure, you have smooth water, a nice working breeze, and a smart ship under you, so stand up to your helm with confidence, and make sure work of it; when you want to tack, sing out to your crew forward, "Ready about!" in a loud, clear, and determined voice,—that there may be no mistaking an order, always accustom the member or members of your crew to whom it is addressed to repeat it, in distinct tones,—thus the answer to your order should be "Ready about it is, sir!" and then the hands proceed at once to stand to the lee and weather jib and foresheets. Now, in order to keep your vessel well in hand, and ensure her having rattling good way on, keep her off a half or whole point until her sails are clean full, just as you would give your hunter a rouse up when coming at a jump you mean to get over surely and fast, and when you feel you have her at top speed, and in good command, sing out "Helm's a-lee!" at the same time (you are on the port tack mind!) putting the tiller very gently down to starboard, and not more than half over; she will fly up in the wind, and the hands should lift the sheets just as the last air leaves the sails, and not a second sooner, right your helm a little, and keep her flying into the wind as long as she has good way, and the moment you feel her slacken, then put the helm three-quarters down, and round she comes sharp; keep an eye to what was your weather, but now becomes you lee jib-sheet man, that he does not haul the jib-sheet aft until the sail has blown clear of the stay, if he does the sail will be taken aback, and a very neatly executed tack may be spoiled by his clumsy handling of the canvas; with moderately smooth water and a good working breeze, a cutter sharply handled never requires the fore-sheet to be kept to windward, both sails should go over at once, and be sheeted home; by practising the above method of tacking, you will gain considerably to windward in the act of doing so, besides ensuring that your vessel will never miss stays, and it must be a poor tool of a ship, indeed, that will not head-reach well in stays, before she requires the lee helm to be sharply given her, and this property should never be neglected in open sea work, as it is of material assistance in shortening the distance to be got over.

I have endeavoured to show you the difference between getting a

vessel well in hand for tacking, and attempting to do so with but little way on; but there is another erroneous method of tacking even with the best way on that causes a vessel to lose speed, and sometimes to miss stays if the helm is put hard down, as it can be at once, and that the sheets are not lifted on the instant, she will lose way, make a bad tack, have to keep the fore-sheet, and sometimes the jib-sheet to windward to pay her head off, and will be very sluggish in getting away on the other tack; it is bitter bad helmsmanship to tack a vessel after this fashion in open water; and a vessel worked as I have previously described, will leave such a handled craft miles astern working to windward.

You must bear in mind the action of the water upon the rudder when it is put over has the effect of moving the vessel's stern aside, either to port or starboard, and that she turns apparently upon a point about one-third of her length from her stem, so that if she be turned suddenly and violently, and that her head sails are still drawing, the two forces become antagonistic, and the result is that her way is stopped, but if it be desirable either to avoid collision, or in working up a narrow channel, going ashore, to jam the helm hard down suddenly, then the head sheets should be let fly at the instant, when her mainsail acting with the rudder will force her round with great rapidity, but with her actual speed in the direction of her keel much diminished, still, however, leaving her sufficient to be in command by the helmsman for any ulterior manœuvre that may be necessary.

I have more than once seen in nautical writings, and heard nautical men use the expression, "she whirled round on her heel!" nothing can be more erroneous or contrary to the fact than this, as the observation of a vessel's movements under weigh will amply prove. You may greatly assist a vessel in tacking, whether you wish to make a long reaching tack, in which it is desirable to maintain speed throughout, or when making a rapid tack with the speed diminshed, by stationing a hand at the main-sheet, and as she comes about, and the wind lightens in the sail for him to keep rounding in the slack of the sheet, so as to keep the wind in the sail to the last moment; in the long tack this springs the vessel still further ahead, whilst in the short one it helps to force her stern round more rapidly in the direction which the angle in the rudder forms with the keel imparts with it. In tacking a vessel during a fresh gale, and with a heavy sea running, somewhat different tactics to those that can be relied on in smooth water becomes necessary; your

vessel will be of course under reduced canvas, and although going along at "high rate of speed," yet from her plunging and uneasy motion in the broken water, you cannot rely upon her with the same degree of certainty as if all her canvas was spread and the water smooth; neither will the action of the water on the rudder be constant from its being occasionally lifted out of the water, for instance, you see a huge wave with a broken curly mass of seething foam capped top, coming down upon you, at which you must boldly put your vessel, and entering her fairly to its crest, drop her down skilfully across the back, keeping your reduced canvas clean full, except just at the moment of entering and passing the crest, when you may be forced to give her a shake up in the wind for a second or two; to attempt to tack a vessel with such a sea coming down upon you would be sheer madness, for should you put the helm down, the advancing sea taking hold of her deep keel, would counteract the effect of the rudder, and the wind being beaten out of the reduced sails by the violent motion imparted to the hull, she would plunge heavily into the succeeding trough with her way quite stopped, her decks becoming full of water, and herself quite unmanageable; the next wave would box her head off,—no matter whether upon the desired tack, or all aback, and rolling her broadside on before it, a regular green sea over all must be the result, leaving a clear deck, and perhaps somewhat more than the mast over the side.

It is a well-known fact, although I never could ascertain any precise rule under the laws of hydrodynamics who it should be so, nor have I ever known any clearly explained solution of the phenomenon advanced by hydrographers, that three very heavy seas will follow each other in rapid succession, succeeded by comparatively smooth water, and this has been observed not only in confined channels, but in the open ocean, when moved by more than ordinary atmospheric influence; bearing this in mind, therefore, when you are caught in heavy weather beating to windward, watch for the smooth that invariably succeeds these weighty seas, and when you are about to tack, send your smartest hands to the head sheets, for a mistake at such a time might involve results of a serious nature; you must keep good way on your ship, and at the same time humour her to the seas, but watch keenly for the smooth, keeping the vessel well in command, and the moment you are in it put the helm down rather more sharply than you would upon ordinary occasions, at the same time handling the head sheets, very quickly, she may require

to be held with the fore-sheet kept to windward for a second or two to pay her head off, but it should be done carefully, and not kept up a moment longer than necessary, as it tends to stop her way. In a short and heavy sea, should the vessel be tender, and that you are sailing her under the reefed mainsail with the foresail stowed, and a small jib set, she must be handled whilst tacking very sharp indeed; if it be found that she requires paying off, then the jib-sheet must be kept up, and it is always good to help a vessel by hauling in the main-sheet hand over hand until she is head to wind, when it may be eased away, and the boom shoved over; if the mainsail should prove too powerful for the small jib, and that she threatens to bring up in the wind, notwithstanding the jib-sheet being kept to windward, then the mainsheet should be eased away until you get way on her, very little will do, and then to get her speed on as quickly as possible, trim the jib-sheet aft the moment her head begins to fall off, hauling in the main-sheet again gradually when you have her under perfect command; in this latter case also it may happen, that just as she comes head to wind, a sea may strike her on the weather bow, and filling the jib, take her aback; this is a very unpleasant position to be caught in, but prompt action will soon take you out of it, keep your main-sheet fast, right the helm, and put it a-weather, let the jib-sheet fly, and she will make a stern board, being brought up by the mainsail as if she were lying-to, and the tiller being a-weather with the rudder to starboard when she makes stern way, it will shove her stern up to starboard, and her head will pay off on the opposite tack; help her now by hauling up to starboard the jib-sheet, and either run up the foresail trimmed to give her way, or ease off a little the main-sheet! A vessel is very often stupid in stays from being over-pressed with canvas, and though she may be helped by the mainsheet in some degree, the only real remedy is another reef; many a vessel and her sails have been found fault with for slowness of stays under such circumstances, when in reality the owner or skipper are alone to blame.

In turning to windward in a narrow channel with a large and fast vessel, and that reefs and shoals are on each hand, it may be necessary to deaden her way, and just merely keep her in command; by tricing up the tack of the mainsail pretty high, and keeping the fore-sheet to windward, you will accomplish this, as the reduced mainsail will lessen her speed, and the foresail being eased down just as she comes round and kept fast to windward, will prevent her head-reaching in stays, and

make her come about in a handy space, giving time for sounding or observations. In tacking with the tide in your favour, the vessel will require very small helm, let her take a long run with the tide in stays, just merely keep her in command with the tiller to ensure her coming about. Every strong puff of wind that you get ease her to it, and let her run up to windward with the tide. In rivers, such as the Thames and Mersey, it is astonishing what a distance to windward can be gained by judiciously working a weather tide in tacking. In the open sea the tides do not run so strong, and the further from land the weaker, until there is scarcely any motion perceptible.

With a lee going tide you must work the vessel sharp, for if you give her too long a run in stays, the tide may catch her with slack way, and heave her away on her broadside before she again gets speed on, thus losing more than double what it was designed to give by running head to wind; therefore, in turning over the tide, you must keep good way on the ship, and giving her the helm smartly, do not allow her to hang a second in stays, always keep her going. Some helmsmen have what is called amongst sailors a sort of gift in working a vessel advantageously over a tide, but this consists of neither more nor less than watching their wind very closely, and working the tide so that it shall take the vessel on the lee bow, and instead of heaving her to leeward, as it must do when striking the weather bow, forcing it to assist her to windward; this is a great perfection in a helmsman, and one which will repay a yachtsman the time and patience devoted in acquiring it; of course a good deal depends upon the steadiness or otherwise of the wind, but with a good breeze and working the tacks sharply, a good hand, by skilfully underbowing the tide, will make nearly as much of it as if he had a weather going tide to help him at the moment of tacking; what he loses in the act of tacking against a lee going tide, he ought to make up by underbowing on the board to port or starboard.

There is one point in connection with the subject of turning to windward, and in fact generally with yachting, that in itself, although extremely simple, has been matter of much perplexity to many; one can understand the difficulty an amateur sailor not thoroughly versed in, or practically acquainted with working a fore-and-after labours under; but I have seen professionals, accomplished seamen, and thorough good hands taken aback when two cutters have been approaching each other on different tacks, by the question, "Are we on the right tack?" strange it may

read, but it is nevertheless true, that I have known instances of as good sailors as ever walked a plank, that if you gave them an Admiral's commission, could not tell when a cutter was either on the port or starboard tack; and I have seen veteran yachtsmen, heroes of many a hard sailed match, completely puzzled when on the verge of a collision, and ask with a bewildered air, "What tack are we on?" A simple rule, if borne in mind, will remove the doubts that will sometimes arise on this subject in moments of excitement; when the wind is blowing on the starboard bow or side of a vessel, and that you are standing aft with your face to the bow, the "port" jib and fore-sheets will be sheeted home, the boom will be on your "port" or left hand, and the vessel will be on the "starboard tack." When the wind is blowing on the port bow or side of the vessel, and you stand facing the bow, the "starboard" jib and fore-sheets will be sheeted home, the boom will be on your "starboard" or right hand, and the vessel will be on the "port tack." The rule of the sea in yacht sailing is, that a vessel close-hauled on the port tack always gives way to a vessel close hauled on the starboard tack, and that a vessel sailing before the wind always gives way to a vessel close-hauled on either tack.

## CHAPTER XL.

"The mainsail, by the squall so lately rent
In streaming pendants flying, is unbent;
With brails re-fixed, another soon prepared,
Ascending, spreads along beneath the yard."—FALCONER.

THERE are some minor details in the handling of a fore-and-aft vessel when beating to windward, that although apparently trivial individually, and as such overlooked when neglected, yet bear their part towards assisting perfect performance, or the reverse; and even no matter how slight the assistance, their observance renders, the neglect of them indicates a slovenly hand, be he at the tiller or trimming sails; for instance, nothing can be more unsightly than to see a cutter's mainsail, after she has made a tack, girthed across from nock to clew, by the boom topping-lift; irrespective of the appearance of the thing, which in itself is enough to make a "neat" hand experience a cold shiver, the tautness of the lift across the belly of the sail makes that part at the line of contact a back sail, and the part immediately, and even for some distance in its wake, slack canvas, which the wind cannot reach, therefore the propelling power being interfered with, the speed of the vessel is lessened in proportion; even when the lee topping-lift-fall is let go immediately to rectify the error, yet the boom having gone over, the sail settles on the lift, and, together with the gaff, jams it aloft against the eyes of the rigging; it is in this position very difficult and often impossible to get the lift to render sufficiently through the blocks so as to give the sail its proper freedom, and even when apparently slacked away sufficiently, yet in the least jump of sea it will be observed to girth a little, proving that it is not properly clear when the sail begins to work with the motion of the vessel in lifting to the sea. There never was a greater instance of the wisdom of the old saw—"prevention is better than cure," than in this very case; therefore, Mr. Tyro, suppose you are on the starboard tack when your sheet-men take their stations previous to going about, the hand that stands by to haul the starboard fore-sheet, first thing he does when he takes his station, let him cast the

weather topping-lift-fall off its pin and overhaul the tackle handsomely not too much, for when freed a little, when the boom comes over, the sail will take sufficient without leaving a bight of the lift blowing away to windward; then when the vessel comes about and he has trimmed and belayed the starboard fore-sheet (now the lee one), let him jump up to windward and haul the port (now the weather) topping-lift-tackle hand taut and belay it; by observing this rule your mainsail never will be caught in such an unseemly and unseamanlike way, however should it even occasionally occur by tacking once or twice to have it properly attended to, your sheetman will soon learn to remember it, if only to avoid the jeers of his shipmates.

The jib is a very important sail and requires a smart and untiring to watch its trim, and withal some exceedingly smart jib-sheetmen when the sheet is trimmed to their satisfaction, nay, often omit looking out for the luff of the sail; notwithstanding even the rigidness of chain jib-halliards, no matter how well set up at the start, either the purchase, or the luff rope, or the bobstay purchase, or all three combined, will stretch, and the luff of the jib will hang away to leeward, it may be in strict consonance with the curve of beauty, but woefully destructive to the effectiveness of the sail; should this escape the vigilance of the sheet-man, it never should the eye of the helmsman, for he should ever watch that the luff of his jib is in line with his forestay: therefore, the moment the least slackness in the luff of the jib is observed, he should sing out, when giving the word "ready about," "and look out for a pull at your jib purchase in stays!" When the vessel comes up in the wind everything is slack, and the lee jib-sheet-man assisted by one of the spare hands can set up on the jib-purchase well and handsomely during the time she is in stays without danger of carrying away anything, for it must be remembered that taking a pull at a purchase when a vessel is all full under way is effected by main force, and when the rope is at its greatest tension, and some times the " " more beef," which is the usual cry for extra help, preludes a pull that an electric telegraph cable would hardly stand. At the same time care should be taken in setting on the jib purchase not to put so much strain on it as to slacken the fore-stay, or you will carry your bobstay and bowsprit out of the vessel. It should always be the object of a good yacht sailor to avoid carrying away anything, and although he knows his gear is fit to trust an emperor's life with, yet if a crew once get the habit of taking these strong pulls on

every trifling occasion, they will neglect opportunities requiring but a little ordinary smartness, the elasticity of rope will soon be destroyed and the heart become broken, and then at a pinch when everything is required to stand for a man's life, away goes a purchase, a tackle, or a halliard, and not unfrequently an awkward accident may be the result. All these things may be done handsomely if the proper time to execute the manœuvre be selected. A rattling good trial of gear at the outset should always be had, but it does not follow as a necessary sequence that because the gear is of the best, it is continually to be put to the severest trials.

In like manner a pull all round may be had whilst the vessel is in stays, peak-halliard-purchase, main-halliard-purchase, topsail-tack-tackle, main-tack-tackle, topsail, topsail sheet, &c., and without putting any out of the way strain upon the gear. Should it be advisable to stand on a long tack and a pull at any particular purchase be necessary before heaving in stays, it is always advisible to ease the vessel up in the wind, which may be done without at all stopping her way, by keeping a slashing pull for a minute or two, and then making an easy half-tack just to give the crew time to take their pull whilst the sails are shaking.

Should the gaff-topsail be carried when the jib purchase is set up, a look aloft becomes necessary, for as every part of the gear stretches in proportion, of course if the bobstay fall stretches, even with a wire topmast-stay (its fall will also stretch a little), and then when the jib is set up afresh the topmast hangs all aback with a slack stay, the topsail won't stand, and then it is very often "take a pull at that topsail-tack!" "pull at that topsail-sheet!" &c. Whereas the simplest and only effectual order is (immediately after setting up the jib) "ease a few inches of the topsail-sheet, and round in on the topmast-stay!" then when the topmast is forward enough belay the stay-purchase, haul out the topsail-sheet again, and the topsail will be set up afresh and stand properly. It is advisible to set up the main tack-tackle previous to rounding out the topsail-sheet in order to effect the complete re-setting of the sail.

Many yachtsmen have an idea that wire rigging and chain halliards obviate the necessity of these precautions, but experience shows to the contrary. Hempen purchases must be used in order not only to work chain and wire effectually, but likewise to impart a certain amount of

spring, or as it is called "life," to what would otherwise prove too rigid and unyielding for the freedom necessary to prevent a vessel being crippled or too tautly penned up in even moderately broken water; this should always be fresh in a yachtsman's mind when handling his vessel; and if necessary of observation in a wire and chain riggid vessel, how much more in those fitted entirely with hemp. These latter are exceptions now, and I have little doubt that the superiority of our modern vessels is attributable in some measure to the wire and chain gear not entailing such a constant supervision of the "nipping up," or "re-setting" of the canvas; but still the yachtsman who will watch the stretching of his gear and slackening of his canvas, and immediately have a "nip up" all round, will have a considerable pull over one who neglects such a precaution.

We talk of flat standing sails as being the perfection of our present system of fitting out, but it appears to be strangely overlooked that these self-same flat cut and flat standing sails, if not properly handled and refreshed, not only when set for a cruise, but in their bending, will not unfrequently become quite as baggy as the old-fashioned sails. When I make use of the term "refreshed in their bending," I will explain what may appear an anomally by calling attention to the head of a mainsail for instance, and ask how many skippers will think of coming up the lacing, and hauling out the earing when the bend of the sail becomes slack, and what their idea of that slackness is—is it only when the sail wrinkles along the gaff that such a proceeding becomes necessary? and I would still further ask some of those amongst our thorough yachtsmen have they not witnessed something nearly approaching to this state of things at our starting buoys occasionally.

I believe that many well-cut sails are twisted out of shape by forcing them with tackles and purchases, in order to make them stand, when a little attention to re-bending them would have effected everything desirable.

In previous chapters I have endeavoured to impress upon young yachtsmen the necessity of making themselves familiar with weather prognostics, and when at sea the moment any premonitory symptoms of a change of weather put in an appearance timely preparation should be made to meet it. Some yachtsmen have an idea that such a course of proceeding savours much of what I recently heard a would-be famous nautical youth elegantly designate as "funk." That in fact their crews

would laugh at and turn them into ridicule as being of a timorous nature and unfitted to engage in the stirring adventure with wind and wave. This may be all very fine for the Corsair school of yachtsmen, who affect formidable smoking caps with prodigious tassels, shirt sleeves, clay pipes, sea-boots mid-thigh up, and unlimited libations of soda and brandy. "Carry on!" is the cry of such worthies; "Carry on and show that you are an out-and-out sailor!" As I could not presume to enlighten such experienced Dirck Hattericks, it would be entirely foreign to my purpose to think of even remotely imputing to them a desire for information, much less a want of it; but to the genuine yachting Tyro I would mildly yet earnestly suggest never to mind what anybody is pleased to say so long as he feels he is doing what is right.

I have known instances of this "carrying on" system, in which the principal actors intensely glorified themselves for a very brief period, until the crashing wail of cruelly-used topmasts, deeply-injured gaffs or crosstrees, or heartlessly-wronged bowsprits, forcibly reminded them that there was a limit of endurance even in wood and iron; and then the contrast between pompous self-consequence at the outset, and abashed incompetence at the conclusion of the farce, would be ludicrous, were it not for the reflection that life and limb is not unfrequently imperilled by such vanity-inspired displays. It is all very well to show a bit of dare-devil hardihood during a race, or when suddenly caught under circumstances that render a little desperate seamanship absolutely necessary to extricate a vessel from a position of difficulty and danger; but it is just at such times that the fiery ardour and indomitable intrepidity of such nautical Hotspurs appear totally to desert them, and when the cool undemonstrative, yet experience-seeking yachtsman finds himself, almost without knowing it, master of the situation. I would say to you, therefore, my young yachting friend, when you are cruising do not uselessly expend your spars, chafe or strain your gear, or twist your sails out of shape, with the purile idea that you are convincing your sailing-master or your crew of your bravery or superior seamanship. Jack is a wonderful mental arithmetician on such occasions as these, and can reckon up pretty square how much to add, what to multiply by, the correct division, and not unfrequently brings out a very small quotient of either commodity. On the other hand you must not let prudence degenerate into vacillation; make up you mind sharp, and having made a resolution stick to it; whether right or wrong go through

with it like a man that had a will of his own. Nothing sailors like so much as decision and promptitude, and even if you do make an error, it is less likely to be regarded as such when carried out boldly. I need hardly say that where such a course would lead to dangerous results, no man imbued with the slightest particle of common-sense would persevere in it; but to the common everyday events only that turn up whilst cruising my observations are meant to apply.

In former chapters I endeavoured to give an accurate detail of safety gear, and their being rove all ready for use in their places, when bad weather impends, it remains with you, Mr. Tyro, to use them effectively and at the proper time. It is much pleasanter and more agreeable to all

over pots, pans, and kettles, the galley fire washed out, and no prospect of a hot, cosy cup of cocoa or coffee to warm them up by and bye—happy-go-lucky for poor hard carried Jack—on go the oilskins over wet clothes, and cold, comfortless, and shivering the crew betake themselves on deck to growl at the thoughtlessness that inflicts so much unnecessary inconvenience: to make matters worse the night lamps are not trimmed, and wick for the binnacle lamp has to be fished out from the bottom of some no-man's-hand locker, which, when found, make a note of against the next occasion. No, Mr. Tyro, I hope you will adopt a different system, and, therefore, as the night looks nasty, we shall begin, if you please, to put our house afloat in order. You are close hauled, and therefore in the most favourable position for working or taking in canvas in a fore-and-after; haul the fore-sheet to windward, round in on the mainsheet until the boom is well inboard for reefing, let the jib-sheet flow; let your crew take their stations for making the vessel comfortably snug; the steward to see his department below—providing for the wants of the night, and seeing that all else is placed in safety from breakage; the cook to see his part of the duty attended to, all his cooking utensils safely stowed away, and refreshment for the crew prepared in case that all hands may be required on deck throughout the night. Send a hand aloft to cast the lacing of the gaff-topsail off the masthead and topmast; let the gaff-topsail-halliard, tack-pendant sheet, and clew-line be manned, start the topsail-sheet, and as you ease it away handsomely haul on the clew-line, and brail the sail up to the yard; this can be most effectually done when the standing part of the clew-line is made fast to the fore-end of the topsail-yard, and the fall rove through a thimble in the leech of the sail, just above the clew, and then through a small tail block on the yard; ease away the halliard and topsail-sheet; hauling down on the tack-pendant and clew-line-fall at the same time, and taking care that the hands at the latter stand well aft, so as to clear the topsail of the eyes of the rigging, and keep the fore-end of the yard from fouling the crosstrees as it comes down, which the clew-line bent as above described will greatly assist in doing. It is usual to get the gaff-topsail down upon the side it has been set upon, and if another is not about to be set in its place, it is better to do so, in order to preserve the fair lead of your gear, it may therefore, involve the casting about of the vessel on the other tack, to enable the topsail to be taken in.

There may exist objections, or it may be inconvenient to tack ship for this purpose, and then the following method of getting a leeward set topsail down to windward must be followed: the hand aloft, when he has cast off the lacing, should haul up to the topsail-tack-pendant, pass it over the peak-halliards, and drop it down to windward; then ease away the topsail-halliards about a foot or so, keeping the sheet fast, let the hands at the tack-pendant haul the sail over the peak-halliards and walk aft together with the clew-line, which will bring the yard nearly up and down the topmast, the masthead-man can now shove the fore-end of the yard clear of the topmast from leeward to windward, and the sail can be hauled down handsomely; the halliard and sheet should be hauled up and passed to their proper leading sides when unbent. We shall now suppose the sail to be on deck: let the halliard and sheet be unbent, and the former secured by its toggle to the mast-bitts; take two half hitches of the standing part of the latter round its fall, along which, when hauled upon, it will run up, and lie along the gaff—snug—ready for use again, and out of the way; unhook the tack tackle from its pendant, unbend the clew-line and tail-block, taking a half hitch with the standing part of the former, so as to keep it rove through the leech thimble, and the tail block on its proper side; turn the tack-pendant and clew-line into the belly of the sail; cast off the yard lacing or knittles, make up the sail along the head, stop it neatly in a tight furl, and stow it away in its proper place in the sail room ready for use again; lash the yard along with the other spars on deck, fore-end forward and peak aft. Sometimes the topsail is kept bent if the heavy weather is not likely to last, and light winds expected in the morning watch; then turn the luff of the sail up along the yard, place tack-pendant and clew-line in the belly of it, furl close and neatly, and stop it along the yard, and lash it on the top of the deck spars until again required. Be particular the moment the topsail-sheet is let go to ease up the topmast-stay-tackle, for the topmast, the instant the strain of the sheet is taken off, buckles forward very much, and if this be not attended to, and that there is any sea on, you will stand a very good (?) chance of springing your topmast. The topmast being disposed of, the next thing to be done is to house the topmast; ease up the topmast-shroud-tackles and topmast-stay-tackle, and cast off the topsail-halliard-fall and signal-halliards a foot or so, but do not let them fly adrift. If your topmast if fitted with wire preventer stays, as all topmasts should be, see that they are also cast loose, so that nothing

may hold the topmast to prevent its being started aloft; then man the mast rope and with a good swig start the topmast aloft, a few inches, so as to enable the topman to withdraw the fid; when he has done this, he should sing out "launch," then ease away the topmast to within about eight to twelve inches of the topsail halliard sheave, and belay the mast rope securely.

## CHAPTER XLI.

"But now the transient squall to leeward past,
Again she rallies to the sullen blast;
The helm to starboard moves each shivering sail,
Is sharply trimmed to clasp th' augmenting gale."—FALCONER.

WHILST taking all needful precautions in reducing the usual working canvas, and making everything snug in anticipation of bad weather, and particularly at the approach of night, yet if by any arrangement easily handled canvas in the shape of a flying topsail can be carried until the gale strikes, and then readily struck, some additional knots may be added to the log and a passage shortened; before, therefore, I proceed with the further detail of reducing sail, it may not be out of place to mention here that a small tidy gaff top-sail cut with a good peak and short luff, so that the yard will set nearly up and down with the topmast, is very useful and effective, set with the topmost half housed over a reefed mainsail, and is very handy for night cruising; a jib-headed topsail is preferred by some yachtsmen for this purpose; but either should be cut specially for this particular service. Thus, when all canvas is reduced and the vessel quite prepared to meet dirty weather, you can set one of the "half-topsails" as they are called, and it is wonderful how they help a vessel along with the strong wind that she has been prepared for strikes, when—let go the halliard—and down the little "breeze catcher" comes in a minute.

Having got your topsail down and stowed away, Mr. Yachtsman, the next sail to demand your attention will be your jib; this must be shifted for one of proportionate size to the number of reefs you purpose hauling down in your mainsail; and as in a previous chapter I drew your attention to the necessity of having your bowsprit fitted so as to work in the gammon iron and bitts as freely as your topmast in the cap, an opportunity of testing the advantage and comfort of attending to such details will now be afforded. You must bear in mind that when reducing your canvas, it will not do to reef your mainsail only and leave the headsails as they were previously, and your bowsprit out to its full extent; such

a mode of proceeding would destroy the balance of your canvas, and make your vessel laboursome, unhandy, and wet—if not absolutely dangerous, as the severity of the weather increased. As a general rule in making or taking in sail, always remember the necessity of preserving the relative proportion of the area of each sail; in order to reduce theory to practice, make a sketch of the vessel under the canvas she would carry close-hauled in a working breeze; make the necessary calculations for finding the position of the centre of effort, having previously made similar calculations for finding the centre of L. V. R. of the hull; then reduce the canvas on the sail draught in the same ratio as you would reduce each sail when preparing a vessel for bad weather, continue the calculations, and it will be seen that unless the same relative proportion be preserved, the vessel will be thrown completely out of trim; nothing will convey to the young and practical yachtsman a clearer notion of the ill effects consequent upon a neglect of this principle.

The proportion generally observed amongst cutter sailers, and which it is to be supposed the sails have been, and if not, ought to have been, draughten to, is with a vessel close-hauled.

No. 1.—Nice working breeze—whole mainsail, large working topsail, whole foresail, and No. 1 jib.

No. 2.—Stiff breeze—whole mainsail, topmast housed, whole foresail, and No. 2 jib.

No. 3.—Strong breeze—single-reefed mainsail, single-reefed foresail, and No. 3 jib set on a reefed bowsprit.

No. 4.—Strong squally winds and sea rising—double-reefed mainsail, double or single-reefed foresail, and No. 4 jib set on a double-reefed bowsprit.

No. 5.—Gale, with moderate sea—three-reefed mainsail, close-reefed foresail, No. 5 jib on close-reefed bowsprit.

No. 6.—Strong gale with heavy sea—trysail and storm jib, with bowsprit slung in.

Let no one persuade you to let the jib and foresail be, and trust to hauling down the foresail to relieve the vessel; some sailing masters and their crews are very averse to what they consider unnecessary work, and to use their pet phrase—"What she can't carry she must drag!" So now if you please we will shift jibs; get up the jib next in size, or smaller, according to circumstances, to the one you are carrying; here the plan of having your jibs legibly numbered on a strip of canvas

attached to the head, will greatly facilitate the finding of the particular one you want; pass your hand along the luff rope to see that it is all clear and no turns in the sail, lay it along the forecastle deck on the weather-bow with the tack forward and the head aft, get the clew clear for toggling on this sheet; leaving this sail all ready, next proceed to take in the one that is set; cast off the outward turns of the jib-tack pendant of the fall, keeping a single turn over the bitts; if you are in a hurry and want to get the sail in extra smart, station one hand in the lee of the foresail, when he is ready, he will sing out, "Let go!" immediately cast off the pendant fall, the jib will fly in along the bowsprit with the traveller, when it should at once be secured under the lee of the foresail by the hand stationed there clasping it in his arms, or what is technically termed, "Muzzling it." It is very necessary in shifting a jib after this fashion, that the hand stationed at the jib halliards should keep a sharp look out for the moment that the jib is muzzled; instantly that he sees it properly done he should cast off the holding turn of the halliards, and let the sail come down by the run; if this be not attended to, the following is sure to be the result:—The vessel having no head canvas to balance her, unless the water is very smooth and the wind steady, will begin to yaw about after a fashion that will not only puzzle her helmsman, but startle the hand in charge of the jib; the head of this latter sail will begin to shake loose from his grasp, and to prevent himself being dragged overboard he will let go; away flies the sail to leeward, beating and flapping in the water, and shaking the mast enough to shake it out of the vessel, and instead of making a smart shift of it, you find yourself in for an hour's hard work in clearing the sail of the fore-foot of the vessel. You will very naturally say, "How can the sail get under the fore-foot?" it is very simply answered by any practical sailor who has witnessed a similar occurrence, no matter in what rig, but to one who wants information on the subject, and wish to be prepared for emergencies of a like nature, I must be a little more prolix; the chances are that the moment the man stationed at the jib halliards sees the hand under the lee of the foresail let go the muzzled jib, he will let go the jib halliards at the same time; the consequence of this is that the sail gets filled with water, is drawn alongside by the speed of the vessel and sucked under her fore-foot, from whence it becomes an exceedingly nice job to get it clear. Under such circumstances the fall has not gone aloft and become unrove, man your jib halliards at once,

and heave the head of your sail over water, ease your helm a little as you see it come, and when you get the body of the sail floating, down helm for a half tack, when it will come alongside, and can be man-handled on to the deck in one-fourth the time you dare attempt it, should it get fairly under her fore-foot; but should the fall have gone aloft and become unrove, then your best plan is to deaden your way, get a hand-line a foot or two below your tack, and heave up the sail so as to permit its being unhooked off the traveller; hold on your sheets, if they have been untoggled, why pass a spare line through the clew thimble, and make fast to the bitts, let go your tack, and the sail will stream alongside, and can be easily handed. If not in a hurry in shifting jibs, and I very much doubt, except when racing, that according to the ancient adage, "the old way is the best way, and most suitable to nature," just heave the vessel to; ease up the lee fore-sheet, and round in on the weather one, help the ship gently with the helm, because all the time that you are preparing to shift the sail you may just as well keep as much way and get as far as possible upon the passage; when you are quite ready put the helm down quietly, round in on the main-sheet until the boom comes well in on the lee quarter; then cast off the main-tack-tackle, man the main-tack-tricing-line, heave up the luff of the sail along the mast, and let the helm take care of itself. The vessel is now comfortably hove-to, and you may proceed in the most leisurely manner to shift every stitch of canvas you may wish.

There is one thing in this manœuvre that will at first rather take you aback, and that is your first experience in heaving-to a four-and-aft-rigged craft; you will feel when her way is deadened, and when after coming up in the wind her after canvas shakes, and the wind takes her fore-sail, making her head fall off until the wind clutching her on the beam lays her over until you fancy she is going to capsize; never mind this, she is all right, and by the force of the wind upon her after canvas will come up in the wind as gradually and surely as the sun crosses the meridian at noon; this in good, steady, average weather is certain, but then there is no general rule without an exception, and the exception to this rule is when the sea is so heavy and the vessel is so lively that you cannot keep what is called "Commanding canvas" upon her; when this is the case you must bring the helm to aid the canvas when hove-to simply steer her as if you were sailing in a match

# ADDENDA.

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Modwena, schooner, 228 tons, built by Boulder & Co., for F. Gretten, Esq.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length for tonnage | 116 | 0 | Topmast fid to sheave | 40 | 0 |
| Beam | 21 | 2 | Topsail yard, extreme | 37 | 0 |
| Depth moulded | 15 | 6 | Boom | 67 | 0 |
| Draught aft | 13 | 0 | Gaff | 39 | 0 |
| " forward | 10 | 9 | Foremast deck to hounds | 57 | 6 |
| Mainmast deck to hounds | 63 | 6 | Hoist of foresail | 48 | 0 |
| Hoist of mainsail | 54 | 0 | Topmast fid to sheave | 35 | 0 |

N.B.—The lower masts have, I believe, been shortened 8ft. from above since the vessel was built.

Guinevere, schooner, 308 tons, built by Camper & Nicholson, for C. Thellusson, Esq.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 133 | 0 | Maintopmast cap to sheave | 35 | 0 |
| " between perpendiculars | 123 | 10½ | Foretopmast " " | 34 | 0 |
| Beam | 23 | 6 | Main boom | 76 | 0 |
| Draught forward | 7 | 6 | " gaff | 44 | 6 |
| Aft | 12 | 0 | Fore " | 29 | 0 |
| Mainmast deck to cap | 79 | 0 | Maintopsail yard | 45 | 6 |
| Foremast " | 73 | 6 | Foretopsail " | 39 | 0 |
| | | | Bowsprit outside | 44 | 0 |

Aline, schooner, 216 tons.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length | 107 | 0 | Foremast | 58 | 9 |
| Beam | 21 | 10 | Boom | 62 | 6 |
| Draught forward | 8 | 3 | Maingaff | 33 | 6 |
| " aft | 11 | 3 | Foregaff | 25 | 6 |
| Mainmast | 63 | 0 | Bowsprit | 34 | 0 |

Egeria, schooner, 156 tons, built by Wanhill, for J. Mulholland, Esq.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length | 98 | 6 | Boom | 52 | 0 |
| Beam | 19 | 2 | Maingaff | 30 | 0 |
| Mainmast | 57 | 0 | Foregaff | 26 | 6 |
| Foremast | 52 | 0 | Bowsprit | 32 | 0 |

Livonia, schooner, 280 tons, for J. Ashbury, Esq., built by M. Ratsey.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 127 | 0 | Maintopmast cap to hounds | 39 | 0 |
| Beam | 23 | 7 | Foretopmast " " | 36 | 0 |
| Draught forward | 8 | 4 | Main boom | 70 | 0 |
| " aft | 12 | 6 | " gaff | 40 | 0 |
| Mainmast | 88 | 0 | Fore " | 28 | 0 |
| " deck to hounds | 68 | 0 | Maintopsail yard | 32 | 0 |
| Foremast | 85 | 0 | Foretopsail " | 28 | 0 |
| " deck to hounds | 64 | 0 | Bowsprit outboard | 37 | 0 |

Cambria, schooner, 199 tons, built by M. Ratsey for J. Ashbury, Esq., now the property of Major Walker.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length | 108 | 0 | Boom | 61 | 0 |
| Beam | 21 | 0 | Main gaff | 33 | 9 |
| Draught aft | 12 | 0 | Fore gaff | 25 | 0 |
| Mainmast | 61 | 0 | Bowsprit | 35 | 0 |
| Foremast | 56 | 6 | | | |

Sappho, American schooner, 848 tons, W. Douglas, Esq.

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 138 | 0 | Maintopmast, cap to sheave | 33 | 6 |
| " between perpendiculars | 124 | 0 | Fore-topmast | 31 | 0 |
| Beam | 27 | 0 | Main boom | 81 | 0 |
| Draught forward | 7 | 0 | " gaff | 47 | 0 |
| " aft | 12 | 10 | Fore-gaff | 34 | 6 |
| Mainmast, deck to cap | 83 | 6 | Maintopsail yard | 56 | 0 |
| Foremast | 81 | 0 | Foretopsail | 56 | 0 |
| | | | Bowsprit, outside | 30 | 0 |

**Alkelda, schooner, 145 tons, the property of Sir W. Topham.**

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 100 | 8 | Beam | 19 | 1 |
| " between perpendiculars | 92 | 0 | Depth | 22 | 6 |
| " on water-line | 87 | 6 | Draught aft | 11 | 0 |
| | | | " forward | 7 | 4 |

**Dauntless, yawl, 170 tons, built by J. Harvey for F. Willan, Esq.**

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 104 | 6 | Breadth | 20 | 5 |
| " between perpendiculars | 90 | 0 | Draught forward | 7 | 0 |
| | | | " aft | 12 | 0 |

**Corisande, yawl, 140 tons, built by M. Ratsey for J. Richardson, Esq.**

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length over all | 99 | 3 | Boom | 55 | 9 |
| Beam | 19 | 6 | Bowsprit outboard | 35 | 0 |
| Draught forward | 7 | 10 | Mizenmast (rail to sheave) | 32 | 6 |
| " aft | 11 | 9 | " boom | 26 | 6 |
| Mast, deck to hounds | 54 | 6 | " yard | 24 | 0 |
| Topmast, fid to sheave | 42 | 0 | | | |

**Iona, cutter, 62 tons, built by M. Ratsey for J. Ashbury, Esq.**

| | ft. | in. | | ft. | in. |
|---|---|---|---|---|---|
| Length between perpendiculars | 69 | 6 | Draught forward | 7 | 2 |
| Beam | 14 | 6¾ | " aft | 10 | 10 |

**Myosotis, cutter, 40 tons, built by M. Ratsey for T. G. Freke, Esq.**

| | ft. | in. | | ft, | in. |
|---|---|---|---|---|---|
| Length | 60 | 1 | Boom | 47 | 0 |
| Beam | 12 | 5 | Gaff | 31 | 6 |
| Mast, deck to hounds | 37 | 0 | Topsail-yard | 33 | 0 |
| Masthead | 8 | 3 | Balloon | 45 | [illegible] |
| Bowsprit, outboard | 27 | 0 | | | |

**Gleam, cutter, 40 tons, built by J. St. Clare-Byrne for D. Mac'Iver, Esq.**

| | ft. in. | | ft. in. |
|---|---|---|---|
| Length for tonnage | 60 4 | Mast, deck to hounds | 36 6 |
| Breadth | 12 6 | Topmast fid to sheave | 32 0 |
| Draft of water forward | 6 0 | Boom, extreme | 48 0 |
| " aft | 9 0 | " diameter | 0 8⅞ |
| Height from water-line at stem | 6 6 | Gaff to pin of sheave | 32 0 |
| " at stern-post | 4 1 | Bowsprit outside stem | 26 0 |
| Length on water-line | 59 0 | Balloon topsail-yard | 46 0 |
| | | Overhang of counter | 7 10 |

**Sunshine, cutter, 20 tons, built by J. St. Clare-Byrne for D. Mac'Iver, Esq.**

| | ft. in. | | ft. in. |
|---|---|---|---|
| Length for tonnage | 47 6 | Mast, deck to hounds | 30 0 |
| Breadth | 10 0 | Topmast fid to sheave | 27 6 |
| Draft of water forward | 5 10 | Boom, extreme | 38 6 |
| " aft | 8 0 | " diameter | 0 7¼ |
| Height from water-line at stem | 5 0 | Gaff to pin of sheave | 27 6 |
| " at stern-post | 3 2 | Bowsprit outside stem | 21 3 |
| Length on water-line | 46 10 | Balloon topsail-yard | 40 0 |
| | | Overhang of counter | 6 6 |

**Aveyron, cutter, 15 tons, built by Robertson for E. Packard, jun., Esq.**

| | ft. in. | | ft. in. |
|---|---|---|---|
| Length over all | 50 0 | Beam | 9 1 |
| " between perpendicular | 43 6 | Draught | 8 2 |

**Pastime, cutter, 10 tons, J. St. Clare-Byrne, Esq., built by Dickinson.**

| | ft. in. | | ft. in. |
|---|---|---|---|
| Length for tonnage | 38 2 | Length on water-line | 37 3 |
| Breadth | 7 10 | Mast, deck to hounds | 25 0 |
| Draft of water forward | 5 0 | Topmast fid to sheave | 22 0 |
| " aft | 6 9 | Boom, extreme | 31 6 |
| Height from water-line at stem | 3 10 | Gaff to pin of sheave | 22 6 |
| " at stern-post | 2 5 | Bowsprit outside stem | 17 0 |
| | | Overhang of counter | 4 9 |